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PEAT AS AN AGRICULTURAL ASSET.

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(Read at the Kalamazoo Meeting.)

In the March number of the Outlook for 1911 is found a charming account of a visit by Jacobb A. Riis to the Director of the Copenhagen Museum.

Under the story of an old hunt of 3,000 years ago, the Director gives a most interesting history of the formation of a peat bog. The story runs as follows:

"The savage hunter hears in the forest the distant roar of a huge beast, the auroch of the stone age. Grasping his flint-pointed weapons, the hunter follows the sound until he comes upon his victim and sends three arrows into the shaggy flank. The wounded beast rushes off into the forest. The hunter follows, but the bull escapes and reaches a little lake, wades in and drinks of the cooling water. The life blood ebbs away, faintness overtakes it and it sinks dying into the water. In the spring the pond lilies grew over the body, and their long stalks twined themselves around the bones. Season followed season and the skeleton settled deeper in the mud. Birch and beech and poplar shed their leaves upon the pond in the autumn. The trees lived their lives and died, and the storms laid them low. Their trunks and branches rotted slowly in the pond. Rushes and reeds grew among them, and by and by moss, layer after layer. As the centuries rolled by, the placid forest lake became a swamp. The hunter with his bow and arrows was gone, as was the auroch. Others came and passed, some that carried weapons of bronze; lastly, men with iron swords and axes. The land resounded to the war-cries of the wild vikings. In their turn they too slept in their cairns and were forgotten.

"From the south came men who preached the peace of the White Christ, preached it with fire and sword. Wars ravaged the land. King fought with king, neighbor with neighbor. The land was laid waste, the forest vanished, the desolate moor moved in. When at last a better day dawned, the face of the country had changed. Where the still forest lake had been, was a peat-bog in which the plover piped its lonely lay. The bog belonged to Farmer Jens Peder Jensen. The village near by you will find on the map as Vig.

"One May day in the year 1905 Farmer Jensen went out with his men to dig peat in the bog. When they reached the sandy bottom of the old lake, they found there the skeleton of the auroch. It was complete except for the under jaw, that had dropped off as the carcass floated about under the warm sun of the long ago. That was found a score of feet away. They sent word to the Museum of the big bones they had dug up, and I went down to look at them. Besides the skeleton they had picked up three arrow-heads, two whole and one broken, the clumsy make of which referred them at once to the earliest stone age, before the men of that day had acquired much skill in fashioning their weapons of flint. In the layers that had formed above it, I identified easily the remains of birch, beech and poplar, the roots of the white pond-lily and of the buckbean. Directly over the bones, the interwoven roots of the common reed of our ditches formed an impenetrable mat; that was when the pond grew over. In the layers above this were the traces of a cranberry bog, then pine cones, and hundreds of hazel-nuts gnawed by mice that had had their winter's stores there. Farthest up were trunks and leaves of a deciduous forest growth that had covered the land perhaps in the day of the Crusaders, and then the mold of the present day." So much for the Director's story.

What is a peat-bog in the eyes of the agriculturist? Simply an immense natural manure pit, provided by the kindness of past centuries, to be conserved and utilized by the modern farmer.

A brief study of soils as they are found at the present day will point out the proper method of application of this valuable deposit. Wiley, in his "Agricultural Analysis," gives eight kinds of soil, as follows:

"1. Sand. Soils consisting almost exclusively of sand.

"2. Sandy Loams. Soils containing some humus and clay, but an excess of sand.

"3. Loams. Soils inclining neither to sand nor clay and containing some considerable portions of vegetable mold, being very pulverulent and easily broken up into loose and porous masses.

"4. Clays. Stiff soils in which the silicate of alumina and other fine mineral particles are present in large quantity.

"5. Marls. Deposits containing an unusual proportion of carbonate of lime, with often some potash or phosphoric acid resulting from the remains of sea animals and plants.

"6. Alkaline. Soils containing carbonate and sulfate of soda, or an excess of these alkaline and other soluble mineral substances.

"7. Adobe. A fine-grained, porous earth of peculiar properties hereinafter described.

"8. Vegetable. Soils containing much vegetable debris in an advanced state of decomposition. When such matter predominates or exists in large proportion in a soil the term tule, peat or muck is applied to it."

A few years since I visited a coral island in the Caribbean Sea, investigating a phosphate deposit. The soil was practically a pure carbonate of lime, or chalk. This soil is an illustration of soil number five, or a marl soil. Large areas of Long Island are almost pure sea sand and illustrate class number one. These soils are practically worthless for agricultural use. The addition of organic matter will convert them into fertile soil. I have traveled over the great wheat fields of western Canada and seen a farmer turning up with his plow the rich black loam that exists to a depth of three feet or more.

What constitutes the difference between the worthless sand soil and the worthless chalk soil and the rich black loam? Principally the presence in the latter of a large amount of thoroughly decomposed organic matter that constitutes what we call humus or humus material.

What now are the beneficial results of mixing peat, rich in humus, with soils deficient in vegetable matter?

1. The first beneficial result is the **lightening** of the soil.

The weights of a cubic foot of different kinds of soil, as given by Schubler, are as follows:

	Pounds
Sand	110
Sand and clay	96
Common arable soil	80 to 90
Heavy clay	75
Vegetable mold	78
Peat	30 to 50

In general the specific gravity of soil decreases inversely as its content of humus.

A study of these figures shows that if we add to a heavy soil composed of sand weighing 110 pounds per cubic foot, an equal amount of peat weighing 40 pounds per cubic foot, we shall have

a resulting soil weighing 85 pounds per cubic foot. If a soil of mixed sand and clay weighing 96 pounds per cubic foot is mixed with peat weighing 40 pounds per cubic foot, the resulting soil will weigh 68 pounds per cubic foot.

2. The second beneficial result is in the increased **absorption of solar** heat by such a soil.

"The quantity of heat absorbed from the sun by the earth is an important factor in the growth of vegetation. As has been established in the physics of heat, a black surface, other things being equal, will absorb a larger amount of heat than one of any other color, so that, other things being equal in the physical and chemical composition of a soil, variations in the amount of organic matter producing greater or less black coloration will affect the heat absorption. Thus, black soils, in the conditions above mentioned, will absorb more heat than lighter colored soils. As a result, the vegetation in such soils gets an earlier start in the spring and matures more rapidly. As an illustration of this it may be noted that the black prairie soils of Iowa produce uniformly crops of maize which mature before the early frosts, while crops grown on lighter soils much farther south often suffer injury from that source."

3. The third beneficial result is the **increased capacity** of the soil to **absorb and retain moisture.**

I quote some experiments from Wiley on this subject:

"A sample of soil from the beet sugar station, in Nebraska, gave the following results:

"First trial ....45.75 per cent water absorbed.

"Second trial ....44.85 per cent water absorbed.

"Muck soil from Florida, containing varying proportions of sand, gave the following numbers:

"Soil number one, 144.85 per cent and 145.43 per cent. Soil number two, 109.13 per cent and 107.93 per cent. Soil number three (very sandy), 46.86 per cent and 46.51 per cent."

As the percentage of peat increases, the capacity of the soil to absorb and retain water also increases.

4. The fourth beneficial result is the **slower evaporation,** or decreased coefficient of evaporation.

If a number of zinc boxes are filled with different kinds of soil and exposed to the sunlight, it will be found that "the rapidity of evaporation in the samples of soil rich in humus and clay will be decreased as compared with the sandy soils."

Let us recapitulate briefly the four advantages that are obtained by the mixture of humus soils with other soils.

1. The lightening of the soil.
2. The increased absorption of solar heat.
3. The increased capacity to absorb and retain water.

4. The slower loss of water from evaporation.

The above four advantages which are obtained by the admixture of peat soil or humus soil with other soils are wholly physical or mechanical in character. They are wholly apart from the fertilizer ingredients that are present in the peat soil. I have no hesitation in saying that the agricultural value of a peat soil which comes from the four physical properties above mentioned, is far greater than the agricultural value derived from the mere fertilizer ingredients present in such peat soil. When we reflect that a sun-dried peat soil, containing 50 per cent of dry material, most of which is organic matter, can be bought at the present time for the market value of the mere fertilizer ingredients therein contained, and that all the benefits, which are of far greater value than mere fertilizer ingredients, are obtained free of cost, we see the great importance of urging upon all farmers the importance of using such a valuable material, especially for admixture with clay and sandy soils.

Let us now turn to a consideration of humus soil from a chemical or fertilizer standpoint.

Snyder (Soils and Fertilizers), says: "The term humus is employed to designate the most active of the organic compounds. It is the animal and vegetable matter of the soil in the intermediate forms of decomposition. Its quality varies with the material from which it is derived. When easily obtained, muck is one of the cheapest forms of nitrogen."

Johnson (Agr. Chemistry): "The organic matter of the soil is chiefly composed of a brown or black substance to which the name humus has been given, composed of compounds of carbon, hydrogen and nitrogen. All these compounds retain ammonia with great tenacity, a property of great utility in connection with the supply of nitrogen to plants. The more organic matter a soil contains the more nitrogen will be present as a rule."

Conn (Soil Bacteriology): "There is a vast difference in the fertility of a sand and a garden soil. Sandy soil may contain all the mineral matters but it lacks the something needed for plant growth which the garden soil contains. This something is called humus. It is the remains of life of previous generations: in a state of decay, plants, animals and micro-organisms contribute to it. Humus is decayed organic matter."

Hilgard (Soils, page 135): "Soil humus is doubtless the chief depository of soil nitrogen and the main source from which, through the process of nitrification, the nitrogen supply of plants is usually derived."

Also page 133: "Not only humus but the insoluble colloid humates produce in the soil a loosening effect, or tilth, which apparently cannot be brought about in any other way."

Hilgard (Soils, page 127): "Normal humus stands very close to peat. Even black peat requires time and aeration (cultivation) and lime neutralization, to serve the purposes of humus in the soil."

Hilgard (page 140, Soils): "Snyder has shown that the richer the organic matter is in nitrogen the more energetically it acts in rendering available the mineral matters of the soil for plant nutrition."

Ladd (Bulletins, Dakota Stations, 24, 32, 35, 47): "With the increase of humus in the soil there is a corresponding increase in the amounts of mineral plant foods extracted from the soil by the Grandeau method."

Hilgard (Soils, page 358): "Nitrification for two years between soil containing only actual humus and that containing only decayed matter, showed 14 times more nitrification in the actual humus material, although the undecayed matter was 40 per cent of the total in the original soil."

Hilgard (Soils, page 357): "The writer believes that the mainly important source of nitrogen to the plant is the nitrification of the humus nitrogen. The unhumified vegetable matter being of no definitely ascertainable value and the nitrates, varying from day to day, being liable to loss by leaching at any time, therefore forming no permanent feature of the soil."

Johnson (pages 155-156): "A due admixture of organic matter is favorable to fertility the more valuable in proportion to the nitrogen it contains."

Conn (Bacteriology, page 63): "Nitrification caused by bacteria is necessary to produce plant food. Ordinary humus will produce plenty. Soil deficient in humus shows little."

Hilgard says humus is the natural food and habitat of the soil bacteria.

Snyder (page 109): "In many of the western prairie soils under cultivation 30 years the humus has been reduced one-half and crop production becomes poor."

Snyder (page 112): "Humus enables soil to store up water and resist drought."

Whitney (Bureau of Soil), states: "Humus renders the soil sanitary, rendering harmless the toxic substances of the soil."

The foregoing authorities practically agree that chemical analyses and culture tests have proved that peat or muck humus in proper condition is

(1) Similar to ordinary soil humus.

(2) That its value is in every way enhanced by higher nitrogen content.

(3) That it has many important and essential functions, physical, chemical and biological, in contributing to plant growth.

(4) Hilgard shows that the thoroughly decayed matter or actual humus has much greater value than unrotted material such as the organic matter of soiling crops or manure unhumified.

Prof. Chas. A. Davis, Peat Expert, Bureau of Mines, cites, in a letter, a field test of the North Carolina Experiment Station in 1907 with a crop of cotton, when plots were fertilized with dried blood (ammoniate) and dry peat (as ammoniate), respectively. The plot fertilized with peat showed 53 per cent increase while the dried blood plot showed 46 per cent increase. The amounts of actual nitrogen in the peat and blood were equal.

Also Bulletin No. 204, Wisconsin Agr. Exp. Station: "In these experiments low grade peat combined with 4 lbs. of muriate of potash and 8 lbs. of acid phosphate to the ton was compared with ordinary manure. Each succeeding year for four (4) years results were noted and in the fourth year the originally poor, sandy soil gave a larger yield of corn where the peat was used than the plot fertilized with manure."

H. B. Fullerton (Agricultural Director, Long Island R. R.): "For a number of years we have been seeking something to supply the exhausted leaf mold or vegetable matter which is the prime requisite for vigorous plant growth. Strawy manure, long used to accomplish this end, is at the present day difficult to secure, hard to handle and offensive, hence we have tried everything we could find with varying success until we struck the black vegetable mold or humus from Alphano. This we have tested most thoroughly at both Experimental Stations with universal success, having raised celery, onions, lettuce and many other crops with no other aid on the light, sandy loam in the central section of Long Island. We have also been able by its use to keep our lawns in superb condition throughout the usual dry season of summer. Hence we have no hesitancy in saying that the utilization of this vegetable matter is a rational method of treating even the unpromising raw material obtained from city cellars, an admixture assuring lasting fertility."

Some experiments just published by Hartwell and Pember in "The Journal of Industrial and Engineering Chemistry," in the August (1911) number, are very pertinent.

"Much uncertainty exists in the minds of agriculturalists concerning the availability of the insoluble nitrogen in commercial fertilizers, because of the difficulty of recognizing the existence of material of low availability, such as leather, garbage tankage, and peat, after they have been subjected to certain processes of manufacture.

"Of the brands collected during the regular inspection of 1908, certain ones which had a fairly high percentage of nitrogen

in organic matter, and which represented different manufacturers, were selected.

"They were thoroughly leached with warm water, by decantation and on the filter, to extract especially the nitrates and ammonium salts, but the soluble organic nitrogen was of course also extracted. The residues were dried, the nitrogen determined and the material used in comparison with dried blood (13.62 per cent N), and nitrate of soda, on an equal nitrogen basis, as sources of nitrogen for oats, millet, and oats, grown successively on the same soil.

"The results from an equal amount of nitrogen in nitrate of soda, dried blood, and the water-insoluble nitrogen of certain commercial fertilizers (Nos. 1-12):

	Grams of air-dry crops				Availability of nitrogen	
	Oats	Millet	Oats		By last oat crop with blood at 80	By alkaline KMnO method
Source or nitrogen	Total	Total	Total	Gr.		
None	(38.5	16.7	25.5	8.0)	0	..
	(48.0	14.7	23.5	8.2)		
1	(64.5	23.6	43.5	14.6)	58	70
	(69.0	21.6	45.5	15.7)		
2	(69.5	24.3	42.0	14.2)	55	59
	(83.0	21.2	45.0	14.0)		
3	(73.5	24.2	50.0	16.8)	76	74
	(71.0	21.5	51.5	17.5)		
4	(78.5	21.3	51.0	17.5)	77	74
	(75.0	23.0	51.0	17.9)		
5	(71.0	24.0	52.5	18.2)	85	78
	(78.5	21.5	55.0	19.6)		
6	(74.5	27.3	49.5	17.3)	72	76
	(74.5	27.7	49.0	17.1)		
7	(78.0	25.7	53.0	18.1)	87	76
	(68.0	23.0	56.0	18.2)		
8	(78.5	26.0	45.0	15.0)	63	73
	(85.5	22.5	47.0	15.9)		
9	(80.5	21.0	49.0	14.3)	74	76
	(82.5	22.0	51.0	16.3)		
10	(76.0	26.8	54.5	17.0)	85	83
	(77.5	22.7	53.0	18.6)		
11	(82.5	22.9	52.5	18.1)	79	83
	(77.5	24.7	51.0	17.8)		

12	(85.0	25.5	53.0	18.9)	81	81
	(86.5	25.8	51.5	17.9)		
Dried blood	(78.0	27.5	52.0	16.7)	80	79
	(67.0	25.8	52.0	17.6)		
Dried blood + or —	(77.5	30.0	56.2	20.6)		
extra lime	(71.0	25.7	45.5	14.7)		
Dried blood (extra	(91.5	28.4	58.0	20.8)		
amount)	(80.0	31.3	59.0	21.8)		
Nitrate of soda....	(86.5	25.9	64.0	24.7)		
	(75.0	27.5	60.0	22.6)		
Nitrate of soda +	(87.5	28.5	63.0	23.2)		
extra phosphate..	(85.0	29.0	64.5	24.5)		

"The increase over the check pots, caused by the general application of nitrogen in the dried blood, has been placed arbitrarily at 80 in the table, because of our belief that high-grade blood under conditions favorable to nitrification will cause an average increase in crop of about 80, in comparison with nitrate of soda at 100.

"It may be seen by comparing the weights of the crops grown on the different fertilizer residues, with those from an equal amount of nitrogen in dried blood, that with a few exceptions the availability of the nitrogen in them was practically equal to that in blood."

The consensus of expert opinion is unanimous as to the great value of peat as a soil maker, a soil renovator and a fertilizer. It is a serious question whether the great value of peat as a fertilizer, should not exclude its use for other purposes. Corn has been used as a fuel, corn makes a good fuel, but it makes a better food. So peat makes a good combustible, but it is a question whether its greater value as an improver of the soil and as a fertilizer does not call for its wise conservation and use in the intensive and more careful agriculture that is rapidly approaching. The farmer is learning to save and to utilize more carefully his barnyard manure. He is also learninig to appreciate the benefits of a wise and intelligent use of commercial fertilizers.

We do not need to depreciate these valuable materials, in order to advocate peat. But we must learn to appreciate the immense value of the greatest natural fertilizer that nature has provided with such generous hand for the agriculture of our day.

PEAT BRIQUETTING.

By G. J. Mashek.*

(Read at the Kalamazoo Meeting.)

The briquetting of peat for fuel purposes, as I gather from reports and statistics, appears to be an old art. In spite of all the work that has been done in this direction in Europe, where many similar undertakings on the Continent apparently have been commercially successful, nevertheless from all reports of effort made to briquet peat in North America, all appear to have been more or less of an experimental nature. There are large deposits of this material in many parts of this country and in Canada, where coal is high, so that it would appear that at least in such localities briquetting of peat would be commercially successful; but from best reports obtainable this does not seem to be the case.

The difference between the success of peat briquetting in Europe and America evidently is due, first to the low cost of labor on the other side, and, second, to the low price at which high grade coal can be obtained in this country. The briquetting of peat in the United States and Canada will undoubtedly have to be worked out on the same lines that the briquetting of coal has gone through. As stated at the outset, the method of handling peat and briquetting it has been worked out in Europe so that good, subsantial machinery can be obtained to do this work over there. This same machinery, however, when imported into this country, does not seem to meet the requirements, and the cost of operation is always higher than the value of the product turned out. This has also been, until within recent years, the history of coal briquetting in this country, although in Europe this is an established business of large magnitude; and yet, of all the equipments that have been imported from Europe into this country, none have been commercially successful. As the result of these failures it was found necessary to develop suitable machinery and processes designed to meet our conditions in order to produce coal briquets acceptable to the American trade. It was learned, in the first place, that the briquets must be considerably better than any of those produced in Europe; second, that they must be produced cheaper, especially as far as labor is concerned; and third, the briquets must be of more suitable sizes and of better quality to compete with domestic coal.

While we have not gone deeply into the briquetting of peat, although we have spent a good deal of time and money in developing machinery and processes for the briquetting of coals, we have equipped one peat briquetting plant to produce high-grade

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briquets. Although this plant was built more for experimental purposes than anything else, it produced a very high-grade fuel, both when straight peat, thoroughly dried out, was used, and also, with a mixture of about 80 per cent of peat and 20 per cent of coal dust; this made briquets practically equivalent to ordinary Anthracite coal. While the pure peat briquets were a little lower in heat units than the mixed ones, the effective heat obtained from them during combustion was equally as great.

I will not enter into the discussion as to the best method of recovering the peat from the bog, as there are several methods of doing this work and machinery for them perfected. The particular process most suitable in a given case will depend altogether on the quantity of raw material desired per day and on the location, size and nature of the bog. As stated before, this part of the busienss is apparently fairly well developed and improvements in minor details will be made as the business is developed.

In my opinion, most of the errors and failures of the past have been made in the method of extracting the moisture from the peat. A certain percentage of this moisture, say down to about 50 per cent or 60 per cent, may satisfactorily be extracted by ordinary drainage and, to some extent, by air drying. After this point is reached, any turning over or handling of the material, to dry it further in the air, necessarily must be expensive on account of the labor involved. It is at this point that a radical departure from the present methods must be adopted, and on account of the high cost of labor on this continent, this further drying will have to be done automatically by machinery.

While all are familiar with the ordinary rotary dryers which will evaporate only from 6 to 7 pounds of water per pound of fuel used, this method is entirely out of question for drying peat, on account of the large consumption of fuel. Therefore, if the drying is to be done at a low cost, a more economical and modern method will have to be adopted, one that will remove anywhere from 20 to 40 pounds of water from the peat per pound of fuel fired. This result can only be accomplished by machinery such as is used for evaporating water from salt, sugar, etc., that is, by using a large rotary dryer which is provided with lifting shelves so as to spray or drop the material from top to bottom in a divided state. Through this sprayed material a current of hot air should be passed preferably by means of a positive blower which will remove the water, not by evaporation but by absorbtion; before going to the drier, the air should first be sent through a pre-heater so designed that it will take up practically all the heat from the furnaces, the preheater being arranged so that the air will pass through heated

brick checker work or around staggered tubes, the inside of the tubes carrying the products of combustion from the furnace.

An efficient dryer of this description has been developed by the General Reduction Gas Co., of 49 Wall Street, New York, and if a machine of this kind is used to dry peat, it would dry it at about one-quarter the fuel cost of the present methods in use.

The drying ought to be carried on until the remaining peat contains about 10 per cent, or less, of moisture. The peat at this point is still not in the most suitable form for briquetting, for the reason that it is brittle and requires a binder of some kind to hold it together. If, however, any kind of binder is used, whether it is sodium silicate, waterproofed flour, sulphite pitch or coal tar pitch, the cost of briquetting, including all labor, fuel and binding materials (exclusive of the cost of peat), will run from $2.00 to $3.50 per ton, depending on the location of the plant. If even then the manufacturer would charge only a reasonable profit on the manufactured product, the price of the peat briquets would still be too high in comparison with coal in all but those sections of the country distant from coal mines, for the reason that the peat briquets will have anywhere from 6,200 to 8,000 B. t. u.'s per pound as against coal of 13,000 to 14,000 B. t. u.'s per pound. In addition, they will burn very rapidly, possess very little advantage over ordinary wood and require considerable labor and attention to keep the fires going. The result of these factors is that in almost all cases it will be cheaper and more desirable, especially for domestic use, for the people to buy coal, as no matter how low a grade of coal it may be, it still would be better fuel than the peat briquets and could be had at about the same cost, when heat units are considered.

With the development of coal-burning furnaces, improved means of transportation, and the lowering prices of coal at distant points from coal mines from year to year, it is doubtful if peat briquets made under the conditions mentioned can compete with coal in any but the most isolated places, especially for steam-making or power-generating purposes.

For the reasons given I have arrived at the conclusion that it is entirely out of question to briquet peat in its natural state, especially when we know from analysis and tests that have been made, that, by retorting the peat in by-product coking ovens, valuable by-products such as tar, wood alcohol, acetate of lime and ammonia may be obtained and the peat carbonized or reduced to charcoal of high heat value. It is then an easy problem to briquet this charcoal dust, either alone, or after mixing with it from 10 per cent to 20 per cent of coal

dust or slack which usually can be obtained at from one-quarter to one-half the cost of ordinary coal.

I am informed by reliable authorities that the market value of the by-products from charring peat, exclusive of charcoal dust, will range from $6.00 to $8.00 per ton of dry peat, which is a larger return than peat will bring in almost any other form in large quantities, and, in addition, there is the peat charcoal dust, the most desirable material for the manufacture of high carbon briquets, which will bring an additional profit of from $3.00 to $5.00 per ton above costs of briquetting.

The addition of coal dust or screenings to the peat carbon dust makes a briquet that is almost as high in heat value as anthracite coal. The coal dust has the effect of retarding the rapid combustion of briquets when made of charcoal dust alone. Briquets produced in this manner are low in ash, will not produce clinker in the furnaces, and weigh considerably more per cubic foot than the raw peat briquets, so that it is an easier matter to store and deliver them, and make a fuel that is superior to charcoal, or in fact, to any coal.

There is no necessity of developing any special machinery for briquetting carbonized peat, as ordinary coal briquetting machinery will handle this material to perfection. This process of utilizing the peat so that everything of value is obtained out of it and the material reduced to its most desirable state, is, in my opinion, the solution for the development of the peat industry.

While a plant to do this work as described above, will call for a considerable outlay of capital at the beginning, I am confident it will be a paying investment right from the start, if installed on peat bogs that are situated where the cost of coal is high. By adopting this process, and getting all the by-products from the peat, which will pay a good profit on the operation, the carbonized peat dust will be obtained for practically nothing. It has very little value except for manufacture into briquets, and for this purpose it is not excelled by any other carbon material.

The cost of briquetting this carbonized dust, including all labor, wear and tear, binder, interest on capital invested, and other fixed charges, should not exceed $1.60 per ton in a plant capable of producing at least 10 tons of briquets an hour. Adding to this 20 per cent or 60 cents' worth of coal dust, valuing it at $3.00 per ton, and 80 per cent of carbonized peat, allowing say $1.00 per ton to the by-product plant, making the cost of peat $.80, this would make the total cost of the briquets in the bin ready to ship $3.00 per ton, which is amply on the safe side. There should be no difficulty in obtaining from $5.00 to $8.00 a ton wholesale for the briquets in almost any part of

this country and Canada where there are large peat bogs located at some distance away from coal mines. By exprience I have found that fuel made in this way will be preferred and give better results than the best quality of Pennsylvania anthracite coal.

Such briquets can be made smokeless by using as a binder sulphite pitch, a by-product from the manufacture of wood pulp, and of which there are unlimited quantities with practically no market for it. This material in its natural state is not waterproof, but can be made so at very little expense.

Sodium silicate, waterproofed by any of the well-known methods, is another desirable binder. This also produces an entirely smokeless briquet, although the ash content of the briquets will be increased from 3 per cent to 5 per cent, depending on the specific gravity of the carbonized peat dust.

Coal tar pitch or asphaltum can be used, but these materials usually are quite expensive, especially if these binders have to be shipped some distance from the producing point, and they do not make an entirely smokeless briquet. Some objections may be raised by the users, to the small amount of smoke produced from the burning of pitch or asphalt binder, which is produced immediately on ignition of the briquets and lasts about ten to fifteen minutes. This smoke or fumes can be entirely eliminated by passing the briquets through a special oven and distilling off the lighter volatiles of the pitch, which produce the smoke. The additional cost of this operation will not exceed 30 cents per ton.

The briquetting plant will be simple, for the reason that no dryers or pre-heaters would be required. All that is necessary will be a mixer, briquet press, binder handling appliances, power transmission machinery, and an oven, if pitch or asphalt is used as a binder. It is impossible to give off-hand the cost of installation of such an equipment as that described, to apply to all conditions, for the reason that these conditions will vary so greatly and must be taken into consideration in making an estimate.

One thing that must be borne in mind in briquetting any material on this continent, is that briquets must be made of a size that will product the best results in the fire. This is a very important item, as a size suitable for steam making purposes would not answer for domestic use, and peat briquets are primarily a domestic fuel and necessarily too high in cost to compete against coal or other fuels for steam making or power purposes. The briquets must be of such size and shape that they will spout, and can be shoveled and handled the same as ordinary coal.

Another point that I wish to draw your attention to is that a high grade briquet of this description must be waterproof and be capable of absorbing a very small amount of water, if any. Under the methods in vogue on this Continent it is practically impossible to transport and deliver fuel in large quantities without the danger of getting the fuel wet, eithe rin cars or in delivery wagons. The process described above will produce briquets that are waterproof and practically impervious to moisture.

Most of you are familiar with or have seen peat briquets, and know that in practically all cases the briquets are either square, rectangular, or cylindrical in form, weighing anywhere from 10 ounces up to several pounds. Fuel in this form is readily accepted in Europe where the people have been brought up to use it in these sizes and are accustomed to break it into smaller and more suitable pieces to obtain the best results from it in stoves and furnaces. In transporting briquetted fuel in cars in Europe, the briquets are usually carefully stacked up, involving a large amount of hand labor.

This method of handling and transportation is entirely out of question in this country or in Canada, for the reason that labor is so high priced. The fuel in this form cannot be spouted and handled by the present appliances, which would run the cost of the fuel too high on account of the handling expense, and there are very few consumers, even among the poorest, who will go to the trouble of splitting up and chopping the large sized briquets into smaller pieces, with the resultant dirt and labor, especially when they are asked to pay a high price for a strictly high-grade fuel.

In order to compete in the market here, therefore, it is necessary to produce briquets of the same size and grades as the prepared sizes of coal now being sold for domestic purposes. I have found the best size for peat charcoal dust briquets to be from 2¼ to 2½ ounces in weight. The fuel must burn and behave in the fire like high-grade coal; life is too short to introduce a fuel that requires special training and special handling in order to obtain the best results.

Briquets produced as described, with the drafts properly regulated and set, weight for weight will burn the same length of time as high-grade semi-anthracite or anthracite coal, and there is no difficulty whatever in keeping a fire over night even in ordinary kitchen stoves.

Another point to which I wish to call your attention is that there is nothing experimental or untried in any of the equipment proposed, as for instance, there is nothing experimental or untried in the method of recovering the peat from the bog and

storing it. These methods, as explained, may differ, and care must be exercised in selecting the most suitable type of equipment to suit the nature and size of the bog and the amount of peat desired per day.

There is nothing new or untried in the absorption dryer. This class of machinery is developed beyond the experimental stage, and there are responsible corporations willing to guarantee the evaporative efficiency of these machines, whether it is desired to dry peat for the by-product retorts or for other uses.

The next step is the by-product or carbonizing plant. This also is not an experiment or an untried process, as there are a number of manufacturers in the coutnry building apparatus of this kind, who are willing to put in apparatus guaranteeing the recovery of practically any by-products that peat may contain. This is done with sawdust, wood, sugar cane, and other kinds of plant materials where the recovery of the by-products offers a satisfactory return, and by-product ovens or retorts, either of the chamber or continuous type, can be utilized for this purpose.

The last step of briquetting the carbonized or charred peat is a simple problem, for the reason that the same machinery and equipment that are used for briquetting coal will make first-class briquets of this material, and there are manufacturers who stand ready to guarantee the capacity and cost of this part of the operation.

The problem therefore resolves itself down to a question of sufficient capital and a proper location, in order to make this business a commercially successful enterprise right from the start, and if this undertaking is engineered properly and if substantial construction and equipment are used throughout, the plant will pay anywhere from 25 per cent to 50 per cent annually on the capital invested, and in addition to the volatile by-products, produce a fuel that will command a higher price in the open market than the best Pennsylvania anthracite.

Propositions of this kind have been brought to me on several occasions, but it was always with the idea of installing as cheap machinery as possible in order to make a showing, no matter of what kind, with the sole object of selling stock, so that it always was a foregone conclusion that the business would be a failure, and this, as a rule, is never discovered until after the stock is all sold and the promoters make their profit; matters of this kind always give a set-back to the development of any new industry.

I have not gone even into the approximate costs of a plant of this description, for the reason as stated, that conditions vary

so much that it is practically impossible to give off-hand figures that would hold in all localities as local conditions must be taken into consideration.

While the method that I am proposing for the utilization of peat is probably not new to those who have made a study of this question, the plan is simply going a little deeper into the subject with the hopes that others will look into it still deeper with the idea of developing the peat industry into a paying proposition, instead of such experiments and trials as all the efforts in this direction in the past seem to have developed into. I have yet to see any reports of any firm or corporation engaged in the recovery of peat for fuel purposes that has declared a dividend. While the declaration of dividends is not the only mark of success, especially in the development of a new industry, it is an absolutely sure and a satisfactory sign.

MEETING OF THE GERMAN PEAT SOCIETY.

Herbert Philipp.

The annual meeting of the German Peat Society took place in Berlin on February 20th and 21st last.

General Secretary Jablonski, in reading the report of the Society, stated that there were but 5½ million acres of peat deposits in Germany, of which but 750,000 acres are being worked. The grants of the imperial and provincial governments have greatly aided the Society and increased its membership. There were at the beginning of the year 12,034 members. Great progress in the agricultural use of peat meadows in Germany was apparent.

Schreyer reported on the trials in growing sugar and common beets on peat meadows, but the results were hardly satisfactory.

Prof. Tacke described observations regarding the effect of frost on peat meadows, with the result that dry deposits suffer more than wet deposits; an observation which opposes the generally accepted opinion and for which no scientific explanation has as yet been found.

Dr. Wolf reviewed the progress made in the gasification of peat for power purposes, including the production of ammonia. The progress of the different gasification methods, etc., has been reported in this "Journal" and covers the ground of the article in question.

Von Lepel thought the sale of peat litter should be standardized, and suggested that the same should not be allowed to contain more than 15 per cent moisture as a commercial article.

AN UP-TO-DATE PEAT PLANT.*

L. B. Lincoln, Chicago, Ill.

(Read at the Kalamazoo Meeting.)

The dictionary defines "plant" as:

"A set of machinery, tools, buildings, etc., for the purpose of conducting a mechanical business; hence the permanent appliances required for any institution."

"Up-to-date" means:

"Fulfilling the highest requirements of the day."

We thus arrive at the following explanation for the term, "AN UP-TO-DATE PEAT PLANT":

"A permanent, established, tried-out means for the production of peat fuel, brought up to the expectations and combining all such appliances as will fulfill the requirements of the present day, and as will suit the conditions of the peat industry at this present moment."

What are these requirements?. In short, they are the continual, commercially practical and remunerative methods of transforming raw peat into the finished product, fuel, so that it can be handled easily; so that it will stand all weather conditions, resist rough transportation and at the same time, that it will be cheap enough to become a permanent substitute for the visibly diminishing coal supply.

While grappling with this problem, we must face the important question: Did any one process, machine or appliance in use on this continent before 1910 fulfill these requirements? The answer is an emphatic "no."

Let us review these divers processes:

Every peat man—no matter how little experienced he may be—will at once and without any dispute overthrow any theory advocating to "press the water out" of peat.

Any experienced peat man will with equal emphasis reject the idea of "**artificial** drying," for reasons obvious and well known. Those who do not immediately realize that artificial drying—though theoretically possible—is a commercial impossibility, must remember the fact, well known to every fuel engineer, that one unit of fuel will evaporate or take care of eight equal units of water. This means that from a raw material containing 92½ per cent water and 7½ per cent peat, we can evaporate water to the extent of 8 times the 7½ units of peat contents, or 60 per cent of water, by using up **the entire** fuel value of all the peat contained. Having thus destroyed all

*Supported by moving photographs taken on the Canada Fertilizer Co.'s peat bog, Farnham, Canada.

the peat the mined raw material contained, and only 60 units of water, the question will stare us in the face: "What shall be done with the remaining 32½ units of water? How will you get rid of those?" There is no peat left to do it with, and additional fuel at additional expense must be introduced for this purpose. The result cannot be but absolutely negative. What we went out to gain, viz.: the peat, contained in the raw material, is all used up, and we are obliged to pay for additional fuel to get rid of the rest of the water. What is left to take care of overhead expenses, and of salaries, management, wear and tear, buildings, etc.? And where will the profit come from?

With the "artificial drying" now out of the way, we will investigate the process known as air drying. The process of air-drying peat is not new. It is spoken of in the Bible. The Israelites are reported of having made their bricks from the slime of the River Nile, and of having dried them by sun and by air. Now, as the French say: "Nous reviens toujours a nos premiers amours." What was in use 4,000 years ago is now again resorted to. A recent report from Egypt advises of the utilization of the heavy slime taken from the river bed and borders and from the bottom of the river Nile for fuel purposes. This muck is nothing else but decayed papyrus, reeds and other decayed vegetable substance—we call it peat.

Peat bricks were also made from the slime, muck and mud along the shores of the Galliean and Dead Sea, which leads us to the deduction that the origin of the peat industry in its primeval state is Judaic. The Irish have freely adopted and continued this method of air-drying peat through untold centuries. It is an undeniable fact today that there is per capita more peat air-dried in Ireland than in any other part of the world, and though it would be interesting to learn the method employed, since it is antiquated and not "up-to-date," this would lead too far afield. The manufacturing of peat, having outgrown the manual cutting and the use of hand labor, became soon subject to mechanical processes which lead to the introduction of machinery into the peat business.

There is a vast number of patented and not patented inventions, of machinery of more or less merit, mostly of European origin, dealing with the making of peat fuel in an improved mechanical way. These different appliances of foreign countries have more or less merit and it will be well to submit such machinery to our most scrupulous and careful scrutiny whenever it enters the peat arena of the North American continent. The most advertised European machinery comes from Germany.

Let it be stated right here: **No** German machine, nor any German process, as Wielandt, Dolberg, Strenge, Heinen. Weber, Lucht, or whatever their name may be, has **ever** produced peat fuel in quantities with commercial success on this continent. In this same category fall all other European,—Dutch, English, Danish, Austrian and French machines. Only one European system has proved its possible adaptability for American conditions, and even this only to a limited extent. This is the Swedish process, now used extensively in Northern Europe and Russia. Many have thought and many still think that what does the work satisfactorily in Europe, should do equally well on this side. But this conclusion is wrong. To begin with, the bogs are different here from across the water. They are here nearly everywhere in their raw, unimproved condition, while many of them are dewatered and drained in the countries I had reference to before. Some of them have been drained for centuries, as in Holland. Some of them were long ago reclaimed and used for agricultural purposes, as in Salzburg, where they were under cultivation even for decades. Another reason is that the climate, the wind-strength and direction, and the moisture contents in the air are in great variance to what they are in Germany, Russia, Finland, etc., at least while just the period lasts during which peat is made and dried. The main reason, however, is the undeniable fact that European labor, unskilled, but easily broken in, can be had for 25 cents per day, and even at less. Indeed, the same Galician labor, once in my employ at 25 cents per day, I employ now at the rate of $2.50 to $3.00 per day; and this help, used to a slashing and rough handling in Europe, must be treated here with great consideration and diplomacy. This brings us to the point where we understand why hand-labor must be eliminated, and why mechanical and automatic machinery is the only advantageous means for a successful and profitable peat industry.

The Swedish system, referred to before, was investigated and an outfit was purchased by the Canadian Department of Mines. It was imported and set up at Alfred at great cost as a demonstration of the air-drying theory.

Statements of the final and unsuccessful outcome of this experiment, and how and why it was finally abandoned, are within the reach of all and we can therefore refrain from considering them at the present moment. The most important reason for this decision was drawn by an eminent authority on peat, Dr. Haanel, the Director of Mines. The following is quoted from his Toronto address to the Canadian Club:

"The Government peat plant at Alfred serves the purpose of demonstrating the manufacture of **air-dried machine**

peat, and is only suitable to be operated on bogs **near villages or by groups of farmers** who own peat lands and who are desirous of making **their own fuel,** as a cheap and excellent substitute for the high-priced coal which they are now obliged to purchase.

"For the manufacture of peat fuel on a large scale, say 20,000 to 30,000 tons annually, **mechanical excavators, spreaders and cutters** should replace the manual labor employed at our plant."

We have thus arrived at the final conclusion, the result of numberless but costly experiments, what the requirements of an up-to-date plant are:

1. The exclusive employ of the air-drying process.
2. The mechanical excavation, and automatic portable machinery in place of hand labor.

Now, that we have reached this clear understanding, and have torn down the ruins of our false beliefs in the possibility of employing in America European systems based in part on hand labor, we can begin to build up a strong structured peat industry, based upon the solid foundation of conservative and slow but steady progress.

Learning from the experience and the downfall of so many domestic peat enterprises, some of them worthy of a better fate, I have erected and built up a complete mechanical system, consisting of:

1. A careful, inexpensive drainage;
2. Portable, self-propelling machinery, combining automatic excavator, picking table, macerator, transmission, moving and conveyor systems;
3. Delivery and collecting system, and
4. The spreading and cutting devices.

No. 1. The drainage system. Experience leads us to a standpoint between those recommending the thorough drainage of a peat bog, and those denying its advisability. As in all things, here too, the "golden middle way" is the best. Experience teaches us that in a bog like the one I worked 1909 to 1911, the main ditch should be about 7½ feet deep, and from 5 feet to 6 feet at the top against 2 feet at the bottom. It should run rectangularly to the direction in which the automatic excavator moves, while operating. It takes care of all the superficial water that drains off the bog, and carries it down to the point of its greatest fall. A number of small ditches, not more than 3 feet deep and 2 x 1¾ feet wide, are ample to make the surface of almost any bog dry and hard enough to support a sensibly devised movable plant. So much about the drain.

My second point deals with the movable plant proper. It consists of a platform large enough to offer sufficient space for all needed machinery. It is supported by a set of caterpillars—that is apron wheels—on which the machine moves in any direction, laying and picking up its own track within the aprons and with no more pressure on the bog than 3 pounds per square inch. (In parenthesis I might say that a human being averages 9 pounds per square inch.) At one end of this platform is a swinging boom mounted pivotally and an endless chain and bucket excavator, which enables us to dig as deep as we decide to, and to make a cut 30 feet wide. The filled buckets deliver to a picking table, necessary only if we work a bog where a complete forest is buried in the bog, and where it occurs frequently that among the thousands of decayed stumps and roots extracted daily, logs are found from 3 to 12 feet in length and from 6 inches to 2 feet in diameter.

After the peat is thoroughly macerated and masticated, it is as a homogeneous mass conveyed to the means provided for delivery by a helicoid or spiral conveyor.

This **third point** in our system consisted during the last season of an exact copy of the "Anrep" delivery system employed by the Canadian Government. It was then the most recommended that could be found among all the different propositions. But from experience I dare say that it falls terribly short of any capacious requirements. The reason is the necessity of frequent track moving, an absolute and very costly waste of time, money and labor, increasing immensely with the enlarged output. Those who visited me at the plant in 1911, while at work, are convinced, and those who have not seen it in operation will agree with me as to its inefficiency if they consider that the larger the output the sooner a row is finished on the drying field, and the sooner a new shifting of rails becomes necessary, during which time the excavation is bound to cease. With only one hundred working days in the season, every single delay has a disastrous effect on the final output. I have now a new system of automatic and mechanical delivery, spreading and cutting, which in its ridiculous simplicity and cheapness does away with the entire superfluous rail and track business, and also with the crew in attendance, cutting down expenses and assuring me against all loss or waste of time and of money. The excavator is independent and keeps on working continually.

The discarded system, however, consisted of a large loop of narrow gauge rail, fastened to light, but long ties, to obtain sufficient bearing surface. As rolling stock, a number of cradle dump cars were used. These were of regular type with the

exception that they are raised about 18 inches above the wheel base for the purpose of a cleaner dump into the field press. These cars were equipped with a contrivance whereby they could be clamped to an endless cable, which, being driven from our main engine on one side, and being tightened to a deadman on the other side, keeps on running uninterruptedly, carrying the cars along with it, until they are unclamped and filled at the end of the conveyor. The loader then clamps it to the cable and it runs out to the field press, which is situated parallel to the rail loop, and a short distance from the farther side of the track. On arrival it is loosened from the cable, the car dumps into the field press and, when empty, is clamped again to the cable, continuing on its return trip.

The field press is a contrivance consisting of a steel frame on runners, that can be quickly taken apart, which is pulled ahead continually by a cable that winds on a drum at the main engine. The end of the field press frame is supported by a smoothing device and is followed by a shaft with coulter blades which take care of the longitudinal cut. The cross-cutting was done by any man that happened to be at leisure, mostly during the time the rails were being shifted.

This is a short synopsis of the arrangement and working of this system. For more technical explanations, I cite from a bulletin of the Department of Mines as follows:

"The dumping cars for the transportation of the peat to the drying fields are transported by means of an endless cable, driven by the same engine as the peat machine. The platform of the peat machine and engine is provided with two rope pulleys, one of which is driven by a chain and cog-wheel, and connected or disconnected by means of a friction coupling.

"The cable—0.36 inch in diameter—runs over two rope drive pulleys and over two guide pulleys located on the track, to the peat machine. From thence it runs to a so-called station car provided with one smaller and three larger guide pulleys. One part of the cable runs from the station car to a horizontal block which is kept in place by a chain running over two vertical pulleys fixed in a frame and kept in place by a weight. The cable runs from the block back to the station car, over a large pulley, and around the track; which is provided at each curve with four rollers. Double tracks are used on the side where the peat is unloaded, so that when the whole width of the drying field is covered, only the curves need to be moved, and general operations can continue with a minimum of interruption. The stretching apparatus must also be move simultaneously in order to keep the cable tight. When the lengths of two sides of the track in the direction in which the peat machine is moved become too short, the whole track has to be moved forward.

"The peat machine is provided with a conveyor which conveys the peat from the machine to the dumping cars. One man couples the cars—when loaded—to the cable while on the drying field another man uncouples the cars and dumps the peat into the field press.

"The field press consists of three parts: (1) front part which re-

ceives the peat mass; (2) middle part for levelling the mass to a layer of uniform thickness, and (3) rear part for cutting this peat layer into parallel rows. When the press is hauled forward the peat layer is cut through by means of knives placed behind and pressed down by weights. The mass is then divided into continuous rows. The peat rows laid out by the press are cut in suitable lengths by a special tool. The press is moved only in one direction, namely, towards the working trench.

"The cable used for hauling the press is fastened to a ring connected with the front side of the press. From there runs over a pulley held in place by anchors, and also over two pulleys placed parallel to the frame of the platform and fastened to a winch at the engine. When the end of the line is reached, the press is loaded on a low truck, and brought back to the beginning of the next line."

I have improved on that as much as consistent with economy and conservation. Instead of 5 cars, I run 8 cars; and I have also improved on the advance move of the field press, which is done automatically.

Motive Power—I use at present a 50 horse power gasoline engine, but electricity converted from a peat gas producing plant is more advantageous. The engine, which is of the best type, has not given us any trouble—in fact it requires hardly any attention except the cleaning, which was done by the engineer whenever at leisure.

It would take too long and it would be inconsistent with the intentions of this paper, to deliver a thorough technical description of every part of the machine. Those who are interested enough to desire thorough information as to the details of my machinery are welcome to it at any time they call on me.

Do not think, gentlemen, that my machine in its present condition represents the final word spoken on this subject. Every year brings new advances in all mechanical contrivances. Think of the annual improvements in automobiles, flying machines, etc. It is the same with peat machinery. Progress is made every year, every day in the year, every minute of the day, and we are learning continually from experience. Still, today I have what is rightfully considered the most reliable and "up-to-date" peat machine on this continent. Though I have already embodied many improvements, I have some more under work. These are now being perfected, and will by far overshadow my success of this year's peat season.

If you consider the enormous advantage which is gained by doing away with the entire rail system, the cable system, the releaser, the loader, the field men and the track moving crews, you must admit that the manufacture of peat offers untold opportunities for experienced open eyes and open mind.

An up-to-date "peat plant management" does not consider

its duties performed with the accomplished fact of peat manufactured in quantities, commercially and at a profit. One of its most decisive duties is to find a regular and profitable market for its output. This leads us into the discussion of peat for power and to the introduction of peat gas producer plants into this paper, which is beyond its scope. Suffice to say that the utilization of peat in the peat gas producer has outgrown the experimental stage and that it was demonstrated a full and perfect success — and the machinery a dependable and reliable product of ingenuity. More on application.

The title of this paper is "An up-to-date peat plant" and **"up-to-date"** I have brought my machinery. I have accomplished what I set out to do, but let no man rest on his laurels, lest he may rust in his tracks and be crushed in the onrush that is bound soon to come, and that will make the peat business in the United States and in Canada one of the most prominent and most interesting enterprises.

New machinery of more or less merit will be invented, old machinery now considered the acme of perfection will be discarded, but the mechanical excavator, and the automatic movable peat machine is here to stay, and machinery that moves over undrained or only partly drained bog will not be replaced. These principles will be as much "up-to-date" in the future as they are at the present moment.

In due course of time those who are in favor of a thorough draining of the bog may gain the upper hand, then we may be able to use to an advantage a machine as now contemplated by the Swede Ekelund, rolling on rails resting on the solid foundation of the bog bottom.

Before making my closing remarks, let me impress on you, gentlemen, that this paper was prepared for the benefit of the peat industry in general—not for any personal or advertising purposes. The harmonious co-operation of all interested parties, and the radical elimination of petty jealousy is bound to bring the American peat industry "up-to-date" and to keep it always abreast of progress. Nothing can we accomplish without peace; and without harmony we can avail nothing. For a house divided in itself cannot stand. We, the members of this splendid Society, are one in our desire to bring about the highest standard possible. We are one in our desire to develop machinery for the utilization of our enormous peat wealth and for the conservation of our other resources. Everyone of us has his own way to reach out for this final result. With united strength we will succeed in making "peat" an "up-to-date" industry, the American Peat Society an "up-to-date" society, and by spreading knowledge for the welfare of our country—we will become **"Up-to-date Peat-Men."**

SOME ASPECTS OF FLORIDA PEAT BOGS.

By J. N. Hoff, New York.

(Read at the Kalamazoo Meeting.)

Much of Florida is little above tide level. Its bogs are therefore of necessity largely tide level swamps. Those above tide level which I have visited in the drained portion of the Everglades and in the Tumbull Hummock lands lack depth and are worth more as truck farms than as sources of peat filler or fuel. The tidal swamps are often 20 feet or more deep and such areas can be bought for as little as $5.00 per acre.

The market value of peat as a filler depends on the nitrogen content, which in Florida peat ranges from 2 per cent to 3 per cent, more or less. As a fuel, the ash content must be low, and if used in a gas producer with ammonia recovery, the high nitrogen content is also of prime import.

In general, any Florida bog fit for farming, especially if below the frost line, would better be used for truck crops. In the long run, it will yield much more profit with much less chance of ultimate loss. Large sections of the Everglades are being drained and converted into truck gardens. Frost is practically unknown and conditions are ideal for winter vegetables, which are shipped to the New York, Philadelphia, Kansas City and Chicago markets in refrigerator cars and sold at good prices. Sometimes as much as $2,000 per acre, gross, is realized.

If attempt is made to work an upland bog for peat fertilizer filler production, draining by open ditches, or diking and removal of water by means of a rotary pump, is the most feasible method. When free of water, the bog can be laid out into fields—say 200 feet wide by 1,000 feet long—a railroad of light, portable track run lengthwise through the center, and the surface harrowed with disk and Acme harrows, and the peat thus stirred up can be scraped to the tracks, as each harrowed portion is sun-dry, by means of a Buck scraper or a Dobson scraper. When sun-dried, it can be loaded into cars and hauled to the plant for further treatment.

Instead of harrowing, the peat can be dug with a Dobson digger and scraped by either method suggested. The use of the Dobson digger, for a well drained bog, for the first three feet in depth, is a very satisfactory method. When the peat is deeper than three feet, the balance can be scraped to the center with two single-drum hoists on each side of the field and Buck scrapers attached to cables so that a scraping is made from one side as the opposite scraper is pulled back for the next load. Such bottom material is quite wet and needs to be disposed in

flat windrows 20 feet wide along the track. These windrows may be three feet or more high. This can be harrowed and each successive layer scraped up and loaded into cars. Such a method permits the bogs, however wet, to be almost entirely removed down to sand or clay.

In the case of tide level bogs of good depth, two methods are practical:

First, by using a dredge pump, the peat, containing about 95 per cent water, can be pumped to the nearest upland by an 8-inch pump and suitable carrying pipe. The upland should be laid out in fields 200 feet wide and 1,000 feet long, with the pipe lengthwise through the center, having plugged crosses every 50 feet. By removal of plugs at any cross, the pumped material will flow out and can be spread in a layer an inch or two deep from the center to each side of the field, or distributed with flexible hose. This spread material can be harrowed, quickly sun-dried, and after building up the beds a few inches by repeated spreading and harrowing, the partly dry peat is scraped with the same scrapers to each side of the field into windrows, which can be loaded into small cars propelled on tracks down each side of the field, to the plant for further treatment. If for fuel, the wet peat may be distributed three or four inches deep and marked off by means of the scraper or other method, and, when dry, gathered to be used directly as fuel.

Second. The second method in use is to dig long canals through the bog, wide enough to operate a dredge pump or bucket dredge, and form long beds or drying grounds on the canal banks, 100 feet wide and as long as possible. The dredged material can be distributed from flexible hose led from the dredge to the drying grounds, which have previously been built up by the dredged material from the canal excavations. Care must be taken to give plenty of slope to the canal banks from the built-up fields, otherwise serious cave-ins will ensue.

Similar methods of harrowing and scraping to those described above can be adopted to sun-dry and gather the peat, which is now loaded into lighters and taken to the plant.

You will note that I have started the description of the peat operation from the field end. It is well to be certain you can obtain your peat cheaply enough and secure a good supply of naturally dried material for satisfactory operation, before investing too heavily in the plant.

Most peat-bog operations come to grief by starting on the wrong end. The problem is the production of the raw material cheaply and in sufficient quantity. Drying is a simple matter, if the field work can be done satisfactorily.

A central power plant with a 100-kilowatt generator will be sufficient to operate the dredge pumps and scrapers, say two units, which should permit the gathering of 200 to 250 tons of sun-dry material per day of ten hours, during the dry season. During the rainy season conditions for preparing the dredged or dug material are likely to be at a standstill. Such a field equipment as referred to would cost at least $7,500, better say $10,000, installed at work.

Now comes the consideration of the plant, which should be fireproof. Neatly every peat plant must burn once or twice to prove this to the average man who tries to produce peat filler or peat fuel without the proper outlay of capital at the start.

A trestle storage should be provided, capable of caring for at least 10,000 tons of sun-dry peat, so arranged as to handle the peat cheaply, preferably with a tunnel belt conveyor, placed lengthwise under the trestle pile, so as to convey direct to the dryer building. The question of dryers is not so serious; as long as there is sun-dry, disintegrated peat to feed into them, either single or double tube dryers will answer. The writer finds that a single tube dryer 6 feet by 40 feet, with a double furnace, each firebox 4½ feet by 6 feet, answers very well. The fire needs forced draught, which can be well supplied by means of a steam turbine fan, which is well nigh fool-proof. A Trump feeder to regulate the feed to the dryer will give a more evenly dried output. The dried material should be screened to 11 mesh, with screens so arranged that the coarse material is milled and re-screened. A roller mill with smooth rolls answers well for crushing the tailings.

The finished product is next conveyed into the cement storage bin, which may have a 12-inch screw conveyor beneath and through the center; this conveyor carries the material to an elevator supplying the bagging bin or the car loader for bulk shipment.

By such an arrangement, the peat filler can be taken without hand labor from the trestle pile into the car for shipment. One 6-ft. by 40-ft. dryer with double furnace will turn out 60 to 100 tons in 24 hours, of material containing not over 10 per cent to 12 per cent moisture and in good mechanical condition for fertilizer use.

If a fuel plant is proposed, the material can be dried down by the sun after marking it out in blocks, fit for producing fuel without the need of artificial drying.

You must expect to invest at least $50,000 in a peat-filler plant, and $25,000 or more, for the production of fuel. This will not include a gas producer and ammonia recovery plant, which will at least double the plant cost, but is the only eco-

nomical way to get the most out of the peat for fuel purposes. This includes the field equipment. A cash capital of $100,000 would not be amiss.

Part of the field equipment I have tried to describe can be seen at a filler plant near Palatka, Florida, and the dryer plant described is in operation at Great Meadows, New Jersey, where all present are invited to visit, if chance is afforded.

The Great Meadows plant is a drained bog with two dryers. From 100 to 150 tons of finished product is made each working day of 24 hours. Weather conditions—and the peat business is largely controlled by this factor—will not permit gathering sufficient material to operate this plant continuously; in fact, the market for peat filler is not large enough to consume 100 tons a day for 300 working days, unless the price per ton was reduced materially. It is not within the limits of this paper to give more than these brief outlines, but I shall be glad to explain to any one interested any features which are not clear to them.

In closing, I might add that the total output of filler will not exceed 30,000 tons per annum from all plants operated in this country and the business has, in almost every instance, paid little or no dividends.

As to the production of peat fuel, either for domestic use or for the production of power and by-products, such a plant is not in practical operation in the United States, although many have been proposed and some operated for a time, but in every case the cost of production rendered the plant a financial failure.

By means of the gas producer and by-product recovery, it is hoped that we may soon utilize our peat bogs to some advantage.

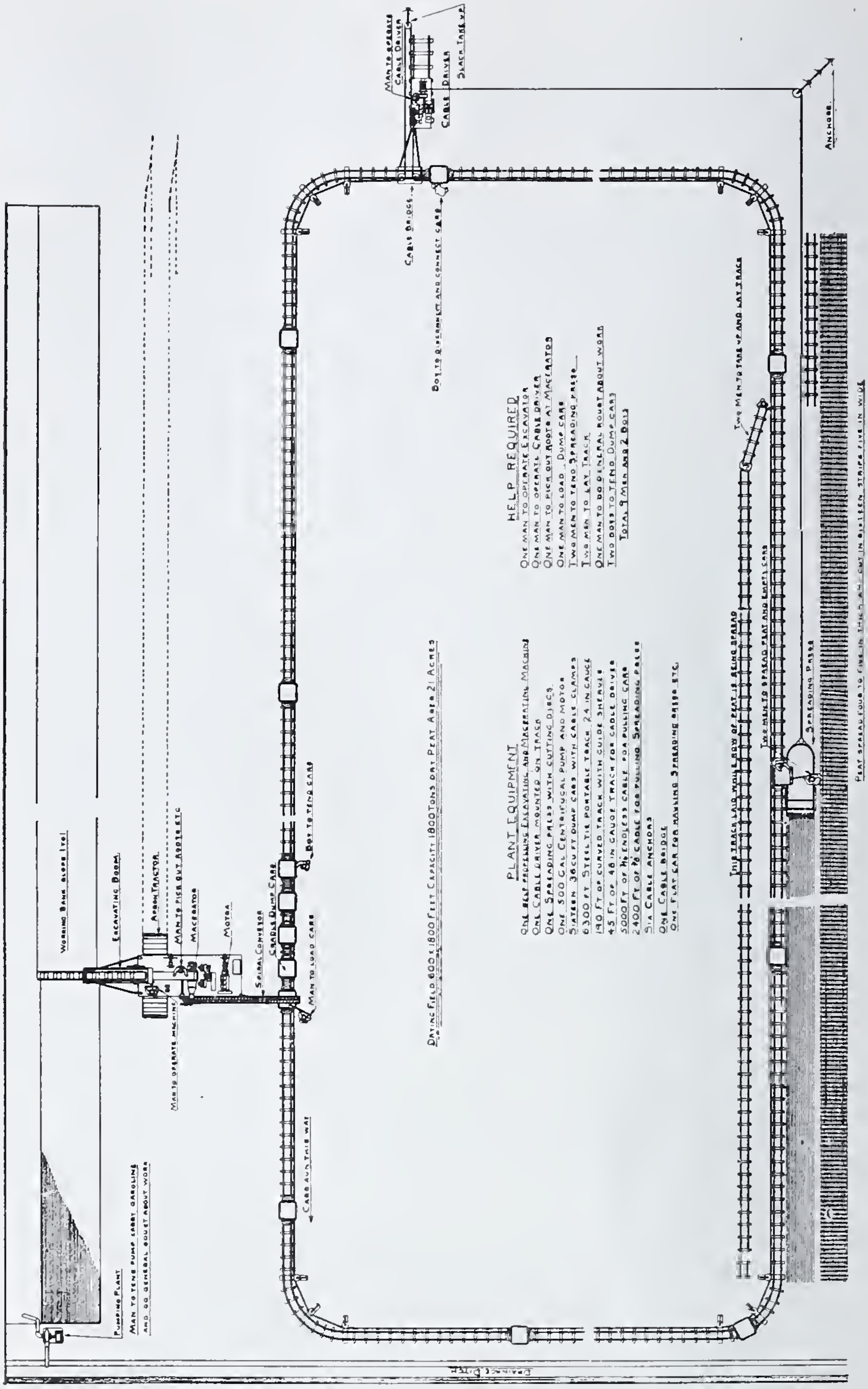

Plate I.—Ground Plan of an Automatic Peat Plant.

AN AUTOMATIC PEAT FUEL PRODUCING PLANT.

L. A. Krupp, Findlay, Ohio.

From thorough experience in the peat industry in America, and investigation of it as carried on in Europe, it is obvious that machinery for producing peat fuel must comply with the following requirements:

First: It must be simple and strong.

Second: It must be capable of being supported on the surface of the bog without means external to itself.

Third: The excavator must be so designed that the least possible delay is caused by logs, roots, etc.

Fourth: All machinery must be of such a nature as to require as little skilled labor as possible.

Fifth: The peat should be dug in such a manner that the moisture content can be regulated within certain limits.

Sixth: The entire plant must work with the least delay possible due to moving of tracks, etc.

The writer has been governed by these requirements in the designing of the automatic peat producing plant shown on the line drawing, Plate I. This plant consists of three distinct units, viz: (1) The excavator and macerating machine; (2) the delivery system; (3) the spreading press.

The excavator is of the endless chain and bucket type, overhung from the side of the machine and working along a bank of 45 degrees slope. The machine is mounted on two traction aprons, the longer of which is shown extended on both sides of the machine near the excavator boom; the other is mounted directly under the motor. The traction aprons may be driven together or separately. By stopping one or the other for an instant the steering is accomplished. It will be seen that the machine moves forward parallel to the working bank and track loop. A cut about one foot deep is engaged along the sloping bank, the traction mechanism set in motion and the machine moves toward the opposite end of the loop, excavating and delivering the peat to the dump cars on the track loop. When the end of the loop is reached a new cut is engaged, the traction mechanism reversed, and the machine returns to the opposite end. The speed of the machine when at work is from three to five feet per minute, so it does not in the least interfere with the loading of the cars.

The macerator is of the latest Anrep type and is shown located at the center of the machine. An endless belt conveyor delivers the diggings from the excavator buckets to the macer-

ator; after leaving the macerator the peat is carried to the dump cars by a spiral conveyor. This conveyor has a movable bottom which can be adjusted so that the peat is always delivered to the center of the dump cars. This feature also does away with the moving of the loading track each time a new cut is engaged. As the conveyor extends 15 feet from the machine, the track needs only to be moved after the excavator has advanced this amount, which is about every twelve or fifteen days. As one day is required for the excavator to travel the length of the loop, which is 1,800 feet, the working bank has a chance to drain out, and by carrying just the right amount of water at the bottom of the trench the moisture content can be regulated at will. By means of a centrifugal pump located at one end of the working trench the water is kept at the proper level. The importance of this can be appreciated when it is considered that diggings with 85 per cent moisture contains 50 per cent more peat than diggings with 90 per cent moisture. As the trench becomes wider the area would be too large to pump, so the excavator boom is raised above the water level about every 30 feet and a new cut started, thus leaving a levee or dam to keep out the water. By this arrangement it is only necessary to pump out a comparatively small area at a time. The motive power is a gasoline engine, but electric power can be used if desired.

The delivery system consists of 24-inch gauge track connected in an endless loop as shown in the diagram. The dump cars are driven by an endless cable from the semi-portable cable drive stationed at the head of the loop, thus making the delivery independent of the excavator. The endless cable is driven by passing it a number of times around the driving drums. A 12-horsepower gasoline engine furnishes the power for this unit.

The dump cars are equipped with clamping blocks which grip the cable. These blocks are adjustable to take up the wear caused by the cable. As the dump cars are filled, they pass in the direction of the arrow to the spreading press at the opposite side of the loop, where they are dumped. The loop is of such length that it requires the spreading press one-half a day to travel across. While the crew are having their lunch the track layers, who in the meantime have laid a second track along the spreading track, connect the corners with the new track, return the spreading press to the starting end of the field, and have all in readiness for the start without any apparent loss of time. The same is done in the evening. The width of the loop is such that thirty days are required to spread over the whole area of the loop. About 1,800 tons of dry peat are

thus produced. By this time most of the first peat spread is dry and either has been removed from the field or piled up. If desired, the loop can again be extended and the spreading carried on over part of the same field, or the whole loop can be carried ahead and a new field started. As the loop decreases in size the slack in the endless cable is taken up by the "take-up" shown at the cable driver. The track is in 15-ft. sections and has steel ties and rails with portable connections, so the sections can be put together and taken apart without any bolts.

The spreading press is a very simple affair of two parts. The front part, or bale, is of channel iron construction; the rear part, or sled, has a weighted box under which the peat must pass. This weighted box has adjusting screws so the thickness of the peat can be regulated at will. At the rear of the press is attached a shaft, on which are mounted round cutting discs that cut the peat into strips or ribbons. These discs can easily be adjusted to cut the strips of any desired width. The press is drawn by a cable from the cable driver by winding on the large drum shown. The speed of the spreading press can be adjusted so as to conform as nearly as possible with the capacity of the excavator. To stop and start the press the operator at the cable drive is signalled. The men at the spreading press dump the cars as they come around and distribute the peat over the width of the press. The dump cars are entirely of steel and of the cradle dump type, 36 cubic feet capacity.

This plant requires the help of nine men and two boys, as follows:

One man to operate the excavator.

One man to pick out roots from the conveyor leading to the macerator.

One man to load the dump cars.

Two men to tend the spreading press.

Two men to take up and lay track.

One man to operate cable driver.

Two boys to tend dump cars at the cable driver and loading point.

One man to carry gasoline and do general roustabout work.

The cost of operating and maintaining this plant for one season of 100 days is as follows:

Labor	$2,050.00
Gasoline and oils	600.00
Depreciation and maintenance	3,000.00
Interest on investment	1,200.00
Superintendence, per year	1,500.00
Total	$8,350.00

The capacity of the plant is easily 60 tons of dried peat per ten-hour day, or 6,000 tons per season of 100 ten-hour days. This makes the cost slightly less than $1.40 per ton of peat, excavated, macerated and dried. If, fortunately, the peat season is longer than 100 days the cost will be decreased, as fixed or plant charges will be the same.

It is of course advisable and thoroughly practical to operate a machine of this kind with two shifts of from ten to twelve hours each. In this case the cost of operating and maintaining the plant will be as follows:

Labor	$ 4,100.00
Gasoline and oils	1,200.00
Depreciation and maintenance	3,000.00
Interest on investment	1,200.00
Superintendence, per year	1,500.00
Total expense	$11,000.00

Working on this basis, the capacity of the plant for a season of 100 working days will be 12,000 tons of peat fuel. The cost of production thus becomes slightly more than 90 cents per ton for peat excavated, macerated and dried.

The plant as described herewith will be manufactured by The Buckeye Traction Ditcher Company, Findlay, Ohio, U. S. A. This company has been prominently engaged in the manufacture of excavating machinery for many years. To those engaged in the peat industry it will be interesting to know that such a reliable concern will soon place their stamp of approval and guaranty upon this class of machinery.

GAS AND AMMONIA FROM PEAT.

What Is Being Done in Germany.

(From The Gas World (London), 56 (Mar. 9, 1912), page 316.)

In an address before the Lower Saxony District Gas Association, at its last annual meeting, Professor A. Frank, of Charlottenburg, gave an account of what he described as the youngest branch of the gas industry, the recovery of engine gas and ammonia from peat. After noting the expansion of the German coal industry in its two branches, ordinary coal and brown coal, which rose to 153 and 69½ million tons, respectively, in the year 1910, he referred to the difficulties encountered in endeavoring to utilize the wide stores of peat as a fuel. Peat is too bulky and contains too much water, and all attempts to use it directly have come to nothing, except under special circumstances, the bulkiness of it being the main difficulty, which made the use of it as a fuel too costly in any form. In Holland, with its system of canals, a good deal has been done in this direction, land being stripped of peat and reclaimed for agri-

cultural purposes; but the same conditions do not obtain in the German peat lands, which are not far short of a thousand square miles in area, with a depth of about 10 feet of peat, of which 12 per cent is combustible when dried. The problem now is, if the peat fuel cannot be brought to the industries, cannot the industries be brought to the peat fuel? And this appears to have been now fully solved. Modifications, by the author and Professor Caro, of the Mond gas process have resulted in a gas containing CO_2 17.4 to 18.8, CO 9.4 to 11, H 22.4 to 25.6, CH_4 2.4 to 3.6, N 42.6 to 46.6, with mere traces of oxygen, and in profitable recovery of the nitrogen in the peat. The heating value of the gas is 157.3 B. T. U. per cubic foot, which is about 50 per cent above the lower limit of heating value suitable for use in gas engines; and at Sodingen, the peat, which contains 1.15 per cent nitrogen, gives sulphate of ammonia to the extent of 4 per cent of the weight of the dried peat. Wood spirit and acetic acid also appear as products. The work has now been taken up in earnest near Osnabrück, and 3,000 horsepower electric energy is being supplied to the town and district, all from the peat gas. Each 1,000 horsepower per annum will cause the stripping of 10 acres of peat moor to a depth of 10 feet. The soil laid bare is good for agricultural purposes, so that land is steadily being reclaimed and inhabited. The large yields of sulphate of ammonia bid fair to play a large part in supplying the demand, which is now outstripping the supply, great though this now is, the production in German gas works and cokeries having risen from 132,000 tons in 1902 to 373,000 tons in 1910.

MEETING OF THE NEW YORK SECTION OF THE AMERICAN PEAT SOCIETY.

One of the most successful meetings ever held by the American Peat Society, or any of its sections, was that which assembled at the Chemists' Club, New York City, on April 9, 1912. The program was about equally divided between fuel uses of peat and the cultivation of peat and muck soils. The program, as announced, consisted of four papers: first, "Fuel Conservation," by Dr. Joseph A. Holmes, President of the Society and Director of the Bureau of Mines, Washington, D. C.; second, "Agricultural Possibilities of Muck Lands," by Prof. George W. Cavanaugh, of the New York State College of Agriculture, Cornell University, Ithaca, N. Y.; third, "Peat Fuel, a Success in Europe, Why Not in America?" by Dr. Charles A. Davis, Bureau of Mines, Washington, D. C.; fourth, "Peat in Agriculture," by Prof. W. R. Beattie, Bureau of Plant Industry, U. S. Department of Agriculture, Washington, D. C.

Unfortunately, President Holmes was unable to be present at the meeting, but in place of his address, the Society was given an account of the progress in the use of peat in the gas-producer, at the experimental plant of the Canadian Department of Mines, at Ottawa, by Mr. B. F. Haanel, the engineer in charge of this work, who most generously consented to talk to the meeting, although he was present only as a listener.

The attendance at this meeting was undoubtedly the largest at any meeting ever held by the Society and the interest was manifested by the fact that the audience remained not only through the long program, but was willing to discuss the papers after the meeting was over. Among those present were Mr. Perry Barker, the engineer in charge of the fuel work of Arthur D. Little, Inc., of Boston, Mass., Mr. B. F. Haanel, of Ottawa, Canada, and his associate on the fuel testing staff of the Canadian Department of Mines; Dr. O. K. Zwingenberger and Mr. Herbert Philipp, of Perth Amboy, N. J., and all of the members of the Executive Committee of the Society were also in attendance. The meeting was presided over by Dr. Charles F. McKenna, Vice-President of the New York Section.

Wisconsin Peat as a Fertilizer. Over large areas in the central, northwestern and northeastern portions of Wisconsin, peat marshes are scattered through the sandy land. This peat, in the dried condition, contains from 2 to 4 per cent of nitrogen, and in the partly dried condition when thrown out of ditches and allowed to dry during the summer, will contain from 1 to 2 per cent of nitrogen, or twice as much as ordinary barnyard manure. The nitrogen of this peat does not become as readily available as that of manure, but experiments have definitely shown that it is a valuable fertilizer on sandy soils. The drier the peat is, the larger will be its content of nitrogen. Applied at the rate of 15 to 20 loads per acre, an amount of nitrogen is supplied that will show its influence for a number of years. On these sandy soils this peat should be supplemented with potash fertilizers, using sulphate of potash at the rate of 50 to 75 pounds per acre. This mixture is especially recommended where the amount of manure provided is not sufficient to cover all the ground requiring fertilizers. In many localities the digging of ditches through marshes for drainage purposes has left large quantities of this peat in a partly dried condition and easily accessible for use as a fertilizer. In these regions it would be profitable to haul this material a distance of two miles at least, for use on potatoes and grain lands. Clay soils which have not been well manured will be equally benefited by the application of peat.—Whitson and Stoddart, Bulletin No. 139, Wis. Agr. Exp. Station, p. 28.

THE PEAT OUTLOOK IN THE NORTHWEST.

Max Toltz, St. Paul, Minn.

(Read at the Kalamazoo Meeting.)

It is a pity that Minnesota, one of the most progressive states of our Union, not alone in agricultural, but also in manufacturing lines (politics not included), has made no decided movement in recovering the wealth which lies in our great and extensive peat bogs, so easily accessible to every man of common intelligence. What is the reason for such inactivity? What is the cause of not being able to interest capital to exploit and develop an industry that could be made the third biggest in the state? To be candid, many reasons can be found to obstruct the immediate carrying out of a policy of manufacturing peat products.

First of all, the people of Minnesota have "bigger irons in the fire" at present. Great strides are being made and new methods are being adopted in agriculture, so as to bring forth the best results from tilling the soil, because farming is the mainstay and backbone of this state and can be classed as the foremost industry.

Secondly: The next greatest industry is the mining of iron ores, which are located not alone in the northeast corner of the state, but which have been discovered even on the west side of the Mississippi river in the center of Minnesota.

Thirdly: "A burnt child is afraid of the fire." Several peat factories have been promoted here during the last decade, but either because of unscrupulous promoters or of inexperienced "experts," the stockholders lost all of their investment. It is, therefore, difficult to interest capital for industries that have proven a failure, although these failures might have been averted under a common sense and honest management. It seems that peat factory promoters are guided by so-called "experts," who must design their own machines for turning out the finished product, and who are experimenting knowingly or unwittingly with processes which even on their face look ridiculous to a man who knows the general principles of peat. Why not use machines that have been tried out and found successful? Of course, such machines can yet be improved, but instead new apparatus must be designed to satisfy the ambition of the expert, who in many instances is honest enough to believe in his own ability and genius.

The last factor of slow development of the peat industry in our state is the unrest of capital, created by many causes. Why should business be disturbed by crops, by the Moroccoan

difficulty, by the activity of the labor unions, by the manipulation of politicians, and last, but not least, by Canadian reciprocity? This state, at large, is on a sound and healthy basis and its resources are simply wonderful, so much so that one of New York's greatest financiers expressed himself, that in twenty years Minnesota will be the richest and wealthiest state in the Union.

In this age of economy it is, however, only a question of time when peat fuel will demand higher and greater consideration. We need cheaper fuel and peat will be the ideal material, if my dreams come true of the ideal power plant, which will not consist of boilers and steam engines, but in which the fuel will be gasified, with the saving of the by-products, such as ammonia and nitrates. We will then not only have smokeless and perfect combustion of the fuel, but also the cheapest power that can be generated.

Rumor has it that there is some activity in acquiring peat-bog lands in the northeastern part of this state and it can therefore be concluded that such acquisitions are made by persons who have had the process of peat coke under consideration for some time past.

To shape the future of the peat industry is the duty of our Society, and to accomplish results means not alone a campaign of education, but good hard work. We must show the general public that peat fuel can be manufactured at a reasonable cost and that the use of such fuel will give a saving in dollars and cents and reduce the present high cost of living. We have to guide investors and, if necessary, denounce such peat factory promotions as cannot, in our opinion, fulfill the promises made for them. We simply have to show by the construction of rational plants that investments will yield certain profits, without any hazardous experiments. Not until then will peat become a factor of national economy and wealth.

FUEL ALCOHOL FROM PEAT.*

(Gas Power, Vol. 9:12:80, June, 1912.)

The following article, taken from the Motor Car Journal, an English automobile journal published in London, relative to the extracting of fuel alcohol from peat, will undoubtedly prove interesting to many of our readers:

The high price of petrol is at last forcing itself upon the attention of the motor public, and it will probably rise still higher until some other fuel for motor cars is brought into competition with it. These fluctuations in price are largely dependent upon the supply of petrol being in few hands; most of the spirit de-

*See also this Journal, Vol. IV, No. 2, pp. 60-65.—(Editor.)

rived from American oil is needed in America, whilst Russian oil yields but a small percentage of the most volatile spirit. The fact that the petrol supply can be thus manipulated by the great oil rings operating outside the sphere of British influence makes it a grave question, as the oil-driven warship, submarine, aeroplane and armoured motor car, which will undoubtedly play an important part in future warfare, would be rendered useless if our foreign supplies were cut off.

As serious as this matter looks, yet we have in the British Isles unbounded material for producing millions of gallons of hydrocarbon spirit, Ireland alone being able to supply the present demand. This material is peat, and, apart from the benefit, it would at the same time make us independent of foreign supplies.

In France, Germany and Sweden the importance of keeping labor on the land and preventing overcrowding in cities has led the Governments of those countries to do all in their power to encourage the production of industrial alcohol. Dotted over Sweden are factories producing peat fuel at a commercial profit, and, as most of them are working on the peat bogs, the cost of production is under 2d per gallon. A ton of peat yields on an average 30 gallons of absolute alcohol, or up to 34 gallons of 90 per cent spirit, whilst still later experiments show that wood sawdust can be made so generous a source of motor fuel that over 50 gallons 90 per cent alcohol per ton can be obtained from it.

The advantages of peat fuel as a motor power are so important that the great wonder is that it has not already entered into competition with petrol. A point which is greatly in favor of the use of peat alcohol in the motor, as compared with all other liquids yielding inflammable vapors, is that when mixed with air in the cylinder there is a greater range of composition over which the mixture is explosive than is found with any of the others. Moreover, the safety of peat alcohol as compared with petrol in not forming an explosive mixture at ordinary temperatures, the power of extinguishing it when on fire by water, and the fact that it only consumes one-third the amount of air for a given power, makes it a far better liquid fuel than petrol. Any internal combustion engine operating with petrol can work with peat fuel without any structural change whatever. An engine designed for petrol can thus without any material alteration be adopted for peat fuel and will give 10 per cent more power than when using petrol, while by alterations designed to adapt the engine to the new fuel this excess of power may be increased to about 20 per cent.

The exhaust from a peat fuel engine is less likely to be

offensive than the exhaust from one using petrol, while it requires no more skill to operate. No undue corrosion of the interior due to the use of peat fuel is noticeable, nor is there a tendency for the interior of the engine to become sooty, as is the case with petrol. The fact that the exhaust from the peat fuel engine is not as hot as that from petrol indicates that there is less danger from fire, less offensive smell from the exhaust pipe, and less probability of burning the lubricating oil. All the above statements are borne out by the fact that the exhaust is smokeless. By reason of cleanliness in the fuel in handling, increased safety in fuel storage, more power and less offensiveness in the exhaust, there is no reason that I know why it should not displace and entirely supplant petrol, even if that spirit dropped to 9d per gallon.

Methods of Preparation of Peat for Gas-Producers. These are reported to vary very widely in the different parts of Europe where the fuel is being used in this way. At no two plants, so far as can be learned, are the same methods of excavating, macerating, and spreading in use. The work is evidently done at the different plants in that way which is most customary in the immediate vicinity, and even on the part of the large companies, there has been no systematic attempt to standardize either methods or machinery for the manufacture of machine peat. As it is reported from all of the plants which have been operated for any length of time, that the peat fuel costs do not exceed $1.50 a ton by any of the methods of producing it that are in use, it is evident that the exact method of fuel production is not of so great importance as has been thought by some of the engineers who have considered the matter in its relation to conditions in this country. It seems highly probable from the reports which we have received from Europe that if production is systematized and carried on from day to day through the season, that at the end of the season a sufficient quantity of serviceable fuel will be obtained to give good results in a properly constructed gas-producer. It is not to be understood, however, that the Editor believes that haphazard production is to be considered, nor that the best machinery possible should not be used for the production of peat fuel for gas-producer purposes. The main thing that should be considered is that, so far as developments abroad have been reported, peat fuel of any form, and made in any way, from cut sods, dug by hand and partly air-dried, to machine peat bricks made by the latest mechanical plants, have all given excellent results in the gas-producer plants in which they have been tried.

C. A. D.

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EDITORIAL NOTES.

The Journal. The present number of the Journal begins a new volume. The Journal speaks for itself so far as improvement with its increasing years is concerned, and with the support of its friends it will undoubtedly grow much faster in the succeeding years of its life than it has in those of its early infancy, now past. It is ready to walk if it can have the kindly and cherishing assistance it needs. Like all very young enterprizes, however, it needs to be looked after carefully, and if its friends are neglectful of it, healthy and continuing growth cannot be expected. The membership of the Society must take a more active interest in the financial support of the Journal if it

is to make the progress desired by many of them, and it is hoped that this interest will manifest itself by a strong increase in the number of members through the concerted action by all of the present membership.

Everyone interested in the development of our peat resources at least should be a member of the American Peat Society. The men who are planning to invest money, or time, in peat enterprises particularly should become members, for a single number of the Journal may save such, many times the annual dues. In addition, as members of the Society, they have the privilege of calling on the officials of the organization for information or advice, a privilege again worth many times the cost of membership.

In spite of these obvious advantages there are not a few officials of peat companies who do not join the Society, or attempt to learn what it is doing. Few, if any, of the men who take up the peat question seem willing, at the outset of their interest, to learn what others have done to clear up the many difficulties which are found in handling peat for the production of any product whatever, but especially of fuel. The substance is a most difficult one to handle on a commercial scale for several reasons, most important of which are: (1) the very large amount of water contained in peat in the bog in proportion to the salable material; (2) the difficulties and cost of getting rid of the water by any mechanical means whatever; (3) the relatively low cost at which the products must be sold in competition with existing materials which are quite as good or better, and which already have an established market.

The man who talks glibly of the ease with which wet peat can be dug and converted into dry fuel, at very low costs, seems to find ready listeners, but he has always many surprises and not a few disappointments in store for him when he really attempts to put his optimistic theories into practice, and fortunate indeed are those who have listened to his siren songs, if they do not share his surprises, and pay the cost of the experience which he gains with their cherished and hard-earned cash.

It is unquestionably true that peat can be made into several products of commercial importance and on a commercial scale with profit. This cannot be done with untried and undeveloped machinery, however, nor by men who do not understand the nature and peculiarities of peat and are without experience in handling it in commercial quantities. In the American Peat Society are men, who have the requisite knowledge of the nature of peat and of its peculiarities, and who have the experience gained by hard work on actual peat operations to give advice and assistance to beginners who are wise enough to join

the Society and ask questions. The Society needs a thousand such beginners, but **they** need the Society much more, if they would save their dollars. C. A. D.

A Great Loss to the World's Peat Industry. During the past winter Mr. Aleph Anrep died at Haelsingborg. Mr. Anrep had long been known as one of the most talented and successful peat engineers of Europe. He was born at Stockholm, Sweden, in 1845, and was graduated from the University of Uppsalla, Sweden, in 1863. From 1865 to 1872, he was lieutenant of the Swedish Royal body-guard. In 1868 he began work on some of the engineering and mechanical problems relating to the manufacture of peat into fuel, and from that time, until his death, he devoted himself entirely to the peat industry. During the two decades from 1888 to 1900 he was employed by the Russian Government to develop the peat industry in that country. During this time he organized and thoroughly established a large number of peat fuel factories in Russia, and his excellent services in this field of endeavor were recognized, and honored by a pension from the Russian Government. At the completion of his work in Russia, he returned to Sweden and, although suffering from paralysis, he energetically took up the work of improving the peat industry of his own country and was especially active in devising improved forms of machinery for eliminating hand labor in the production of machine peat. In 1901, he was given the Prize of Honor by the King of Sweden. It was through his efforts also that the government erected the peat school at Emmaljunga, which, later, was removed to Markaryd. Mr. Anrep was director of this school from its establishment until 1906. The latest production of Mr. Anrep's mechanical skill was the excavating machinery which was finally completed and thoroughly tested during the season of 1911.

Peat Fuel Wanted. A coal and fuel dealer in Delaware wrote recently to learn where peat fuel is being prepared and to whom he should write concerning it, as he wishes to buy it by the shipload. At the time his letter was received, no place nearer than Europe was known where he could obtain the desired peat.

Fossils from Peat Beds. Recently Mr. L. B. Lincoln sent to the editor the fossil bone from the foot of one of the large animals of deer tribe, found in a bed of peat 6½ feet below the grass roots, or 8 feet below the surface. This was found in a State where the particular animal from which the bone came

has long been extinct; hence, it was of very considerable interest to the geologists. This item is published with a view to calling attention of all workers in peat bogs to be on the lookout for the bones of extinct animals. Very considerable effort is being made by the students of geological history to trace out the distribution of the larger land animals during the time just preceding the settlement of North America by white men, and the bones of these animals give unmistakable evidence of their occurrence in a given locality. It is very desirable, therefore, that any of these relics, whether they are large or small, should be carefully preserved, with a record of the exact location where found, and sent to someone who will be able to classify them. The Editor will always be glad to receive specimens of this sort and will see that they reach the scientific authorities to whom they will be of most interest and value. Many valuable scientific discoveries have been made in European peat beds, but those of the United States have scarcely been studied at all. Will the American Peat Society aid in this work?

Peat in the Gas-Producer. At a recent meeting of the American Chemical Society, Mr. John D. Pennock made the following statement: "The ultimate solution of the problem of the utilization of peat will probably be the conversion to gas in a producer and in the utilization of this gas in gas engines, for the handsome return from 110 pounds of sulphate of ammonia saved per ton of dry peat gasified will make the proposition very profitable. On account of the high percentage of oxygen in peat dry distillation destroys the ammonia, but in the Mond producer peat containing 50 per cent of moisture may be gasified, showing 75 to 80 per cent conversion of the nitrogen of the peat into ammonia. Four thousand cubic meters of gas of 1,400 calories are obtained from a ton of peat and from 3 to 6 per cent of tar, containing 15 per cent of soft paraffin and 50 per cent of neutral oils suitable for Diesel motors.

Peat Development in Denmark. An English syndicate is reported from Copenhagen, Denmark, as spending large sums of money in trying to develop "peat coal" from the Danish peat bogs. It has been estimated that Denmark can thus supply itself for fuel for a hundred years to come, the bogs of that country containing about 300 million tons of peat suitable for heating purposes. The company is building its first factory in Zealand where work has already started. It is reported that the syndicate has a capital of several million dollars and that its operations will be extended to France, America, Russia, Siberia and China.

Peat Fuel for Canada. Canada's area of peat bogs, 37,000 square miles, constitutes a potential national asset of enormous value, according to a circular by the Canadian Peat Society. Four bogs within a few miles of Ottawa are estimated to contain over 25 million tons of fuel. It is also pointed out in this circular that Ontario and Quebec provinces send annually $20,-000,000 to the United States for coal, and that the development of peat bogs would keep the money at home as well as supply work to Canadian labor.

Mr. L. B. Lincoln has opened offices at 1005-112 West Adams Street, Chicago, Ill., as consulting peat engineer and bog examiner. Mr. Lincoln has been making an active campaign during the winter and more recently has been delivering lectures on peat development and testing bogs in various parts of Minnesota and Wisconsin.

Executive Committee Meeting. A meeting of the Executive Committee of this Society was held at the Chemists' Club, New York City, April 9, at 3:30 P. M. The various sub-committees reported and the needs and progress of the Journal were discussed. The contract for publishing, the duties of the editors, and the need of securing larger circulation and more advertising were brought up. The Editor-in-chief, who was present, briefly outlined some of the difficulties which were met by him in his editorial work, and after full discussion the matter was referred back to the Editor for such action as he deemed advisable. The committee on membership also made certain recommendations and reported favorably on several applications for membership. Another topic of interest was the preliminary program for the annual meeting, to be held in New York in September. The relationship of the meeting to that of the Eighth International Congress of Applied Chemistry was discussed and the matters of headquarters for the meeting, the employment of an official stenographer, and the entertainment of visiting members were discussed. The meeting was fully attended and great interest was shown in the reports presented.

The Goerlitz Machinery Co., of Goerlitz, Germany, during the winter, opened negotiations with the Secretary of the American Peat Society with a view to loaning the Society the 300-horsepower peat gas-produces and electric plant which they had in operation at the East German Fair at Posen during tre summer of 1911, for experimental purposes. After submitting the matter to the officials of the Society and thoroughly canvassing

all possibilities, it was regretfully decided by the Executive Committee that the necessary $40,000 or $50,000 which would be required to import the plant and develop a fuel-producing installation in order that the necessary supply of peat fuel could be furnished, could not be raised. The enterprise of erecting and caring for so large a gas-producer and all of the necessary accessories, even if the plant and the machinery accompanying it were loaned, was altogether more than the Society with its present small income and membership could manage. The Posen plant has been mentioned in several numbers of this journal and will be fully described. During its operation at Posen, peat with 40 per cent of water was used and a consumption of about 2.2 pounds (1 kg.) per horsepower hour was reported.

W. F. Todd, of Calais, Maine, after three years' suspension of active interest in peat, has had his interest renewed recently. It will be remembered that Mr. Todd was a pioneer in the peat litter business in this country and as far back as the end of the last century had a fully developed factory for making stable litter from peat, located just across the line in New Brunswick. This plant was just beginning operations when it was destroyed by fire and was never fully rebuilt.

The New Rapid Filtering Press, devised by Dr. Oscar Dyckerhoff, of Nuernberg, Germany, is being installed in one of the largest German peat plants for the rapid drying of the peat which is to be used in gas-producers. The proposition which Dr. Dyckerhoff has reported is an exceedingly attractive one, and it is hoped soon that full particulars regarding it and the results of actual tests will be received.

Mr. G. E. Boberg, 1027 Buchannan St., San Francisco, Calif., reports that at the tests of his patented method for removing water from raw or freshly dug peat, which were made in March at the laboratory of Smith, Emery & Co., San Francisco, peat with 94 per cent water was reduced to dryness in 12 minutes. Details as to costs of working the process on a large scale are awaited with interest.

Fire in Peat Plant. It was reported recently that the peat filler factory at Espy, Pa., had been damaged by fire. Such fires are not uncommon in plants where large quantities of powdered peat are dried in direct heat driers and stored, and the only way in which loss can be avoided is to build the exposed parts of the buildings of some fire-proof material.

Mr. E. C. Moore, of Peterboro, Canada, was in New York City during March on business and reported to the Secretary that the peat enterprises in which he was interested were progressing with very satisfactory speed towards final completion during the early spring. Later reports from Mr. Moore state that it will be entirely probable that the company in which he is interested will have their plant in operation during the early summer.

Mr. L. H. Krupp, formerly with the Peat Industries, Ltd., of Montreal, Canada, has severed his connection with that company and is now in the employ of the Buckeye Traction-Ditcher Co., of Findlay, Ohio. Mr. Krupp is still interested in the development of peat machinery, as is indicated by the plant which he describes in the present issue of this Journal.

NEW COMPANIES.

The Minnesota Fuel Association, Mankato, Minn., and Chicago, Ill. L. W. Parsons, President; E. R. Jackson, Vice-President; F. B. Smith, Secretary-Treasurer. Chicago office, Merchants' Loan and Trust Building. This company has issued a very attractive little brochure illustrated with half-tone pictures, showing the various operations of manufacturing air-dried machine peat by the System Lincoln. The printed matter is of interest also, and gives the salient facts about the characteristics of peat.

The Farmers' Peat Fuel Co., 933 North Meridian St., Indianapolis, Ind. Robert S. Lawrence, President; David B. Hill, Vice-President; David R. Murray, Secretary-Treasurer. The only printed matter received from this company is a statement that the company is manufacturing and selling a portable peat ball machine, which is a former and compressor; this, with its accessories, a grinder, hand-car mixer, and tools, weighs crated 600 pounds. The machine is to be operated by three men and a boy, who together can turn out 8,000 pounds of finished product in 10 hours. In addition, this circular makes a series of statements regarding the possibilities of the machine and of peat fuel.

The Connecticut Peat Fuel Co., Hartford, Conn. Charles E. Wetmore, President; Edward A. Beals, Treasurer and General Manager; Clarence H. Wickham, Secretary. This company has not yet issued any prospectus, but is manufacturing peat coke and charcoal.

REVIEWS AND ABSTRACTS OF RECENT PUBLICATIONS ON PEAT.

(Publications and Articles intended for Review in these columns should be sent to Dr. Herbert Philipp, Exchange Editor, Perth Amboy, N. J.)

Class I.—Peat Plant and Machinery.

Anrep Machine for the Manufacture of Peat. E. V. Moore. Jour. Can. Peat Soc. 1911 Vol. 1, p. 14.

The machine described here is an improvement on the Anrep structure at Alfred, Ont. The machine travels on a portable track; the bucket type excavator is so mounted to leave all working surfaces on a natural slope, the depth of the cut being automatically adjusted. The buckets drop the peat into a hopper, which delivers it into a stationary trough, the trough in turn delivers the material into the hopper of the macerating machine. The pulp from the macerating mill is conveyed to self-dumping cars, which in turn deliver it to the spreading apparatus. The mechanical design of the apparatus is simple, strong and light with wide distribution of weight.

Cost calculation for plant and operation are given showing a cost of $1.25 per ton of peat at the plant storehouse. H. P.

Drying Apparatus. H. C. Russell, Eng. Rev. 1912, Vol. 22, p. 43. The author deals with the subject in a very broad and general manner, taking up separately each factor which comes under consideration in problems connected in drying various types of materials. The article deals in a general sense with temperatures, drying period, humidity, moisture, air supply and loss of temperature. H. P.

Apparatus for Turning Peat Blocks. Thomas A. Mighill, Cambridge, Mass. U. S. Patent 1,015,390. Patent Office Gazette, 174, January 23, 1912. pp. 875-876. (It is hoped before long to publish a full account of this apparatus.)

Process for Dehydrating Raw Peat by Compression and the Addition of a Porous Substance. E. Abresch. French Patent 434,084. September 9, 1911.

A Process and Apparatus for Extracting and Conveying Peat. The Peat Coal and Investment Co., Ltd. French Patent 433,527. August 23, 1911. Also English Patent 13,391, 1910.

Drying Wet-Carbonized Peat. N. Testrup and O. Soderlund. London, England. English Patent 4,684, February 24 1911. Water is removed from wet-carbonized peat prepared according to English patents 10,834 and 20,420 of 1903 and 6,041 of 1910, by first passing it through a filter press under a pressure of about 100 pounds per square inch and treating the residue in a band press under a pressure of about 600 pounds per square inch. The amount of water contained in the peat is

reduced in this way from about 90 to 50 per cent, and the solid material thus obtained is suitable for direct use in a producer for conversion into gaseous fuel.

Class II.—Peat Fuel and Briquets.

Manufacture of Fuel Briquets. A. A. A. Zimmer and G. F. Forwood. Br. Pat. 22,835, 1910. This invention relates to an improved process for the manufacture of briquets from coal dust, coke dust, peat dust, and the residue from ore smelting processes such as flue dust, fines, and the pulverised ores. The process consists in reducing coal or coal dust to a plastic condition before mixing with it the material to be briquetted and completely forming the briquets, while the mass is still being subjected to heat. In accordance with the invention, a binder is formed by taking dust of a good caking bituminous coal, and this coal or coal dust subjected to a process of dry distillation until it is in a plastic state. When in this condition there is thoroughly mixed with the plastic mass a suitable quantity of any of the granular materials aforesaid that it is desired to incorporate into the briquet. After the mixing of the substances has been effected in the foregoing manner, the mass is compressed through a tube of the required shape kept sired form while still subjected to extraneous heat. The plastic mass is compressed through a tube of tre required shape kept at a temperature sufficiently high to maintain the plasticity of the mass, and the briquets are cut into lengths as the mass emerges through the open end of the hot tube. The gases and other by-products of the distillation process may be utilized in any desired manner. H. P.

Treating Peat for the Production of Fuel. J. Anderson and J. Hippius. Br. Pat. 9,657 (1911). The invention relates to a continuous process for treating peat while moist or mixed with water under a high hydrostatic pressure, simultaneously applying heat and thereby converting such matter into fuel of a high calorific value. The claim is for a process and apparatus which permit of treating peat by heat in autoclaves, in which is maintained a constant pressure greater than the pressure corresponding to the temperature to which the organic matter is heated so that the heated mass does not boil. In Br. Pats. 10,834 and 20,420 of 1903 M. Ekenberg proposed to do away with closed vessels and to carry out the heating in long and narrow tubes with open ends, even inserting one tube within another, so that in the narrow space between the tubes the semi-fluid mass propelled by archimedian screws would produce sufficient friction, therefore reaction, which would guarantee the mass being subjected to a high pressure. The pat-

entees return to the idea proposed by Vignoles and use closed vessels, but with the object to make the process a continuous one, which was not possible with the closed vessels proposed by Vignoles, apparatus is introduced which permits of a constant pressure being kept up in the vessels and at the same time permits the mass treated to be practically speaking continuously and automatically withdrawn from the interior of the vessels. The necessary pressure in the vessel filled with the semi-fluid mass is maintained by using a hydraulic accumulator or any apparatus which can replace an accumulator, such as automatic clutches and differential gears, which regulate automatically the work of the pumps which supply the accumulators. The necessary pressure in the closed vessels can also be maintained by forcing into the heated vessels air or gas under pressure. By the application of a mechanical discharging apparatus, which also acts as a regulator, it is possible, under certain conditions, to utilize the energy in the highly-heated semi-fluid mass being treated and to convert this into work, or, in other words, the discharging apparatus can be made in the form of a prime mover—any of the well-known types of hydraulic or steam engines with slight alterations can be used as discharging apparatus. H. P.

Steaming Tests. L. P. Breckenridge, Henry Kreisinger and W. T. Ray. Bureau of Mines, Bulletin 23. This bulletin includes a test with peat. The peat used was Florida peat briquetted. It was found that the peat burned freely and quickly with a very long flame. The briquets did not crumble in the fire. Automatic air admission was operated. The fire was easily handled. A small amount of heavy clinker of brownish color formed on the grate; it was easily removed. High capacity was developed. The moisture in the steam was estimated. H. P.

Briquetting Peat and Non-Briquetting Material. A. Zinderler, Berlin, Germany. U. S. Patent 1,000,479. Aug. 15, 1911. The peat is mixed together with such materials as anthracite coal or iron ore, which are then heated to a sufficient temperature to liberate bituminous matter which acts as a binding material when the briquets are formed. H. P.

Drying Wet Carbonized Peat. N. Testrup and O. Soderlund. Br. Pat. 4,684 (1911). Water is removed from wet carbonized peat prepared according to Ekenberg's patents by first passing it through a filter press under a pressure of about 100 pounds per square inch and treating the residue in a band press under a pressure of about 600 pounds per square inch. The amount of water contained in the peat is reduced in this way from about 90 to 50 per cent. and the solid material thus ob-

tained is suitable for direct use in a producer for conversion into gaseous fuel. H. P.

Danish Peat. Chem. Trade Jour., Vol. 50, p. 599. It is reported that an English Company has bought up a large area of peat bog in Denmark, with the intention of erecting factories for the purpose of producing briquets from the peat. According to the estimates, the capital expenditure on the plant will amount to over $1,500,000. Denmark is now an importer of nearly three million tons of British coal per year, but it is hoped by Danish consumers that she will become more self-supporting, so far as fuel is concerned, when the peat bogs are properly worked and made use of, although peat has not made much headway against coal in any country as yet. H. P.

Peat Powder to Supplant Coal? Mining and Engineering World, December 2, 1911, p. 1102. In regions where peat bogs bemire the landscape and coal is expensive, recent Swedish experiments with peat powder fuel may prove of interest. These experiments following upon the commercial failure of peat briquets on Swedish railroads were conducted with a view toward utilizing peat in pulverized form in stationary boilers for steam generation, and also for electric ore smelting. In these fields the prospect for success are promising.

In experiments at the Sahlström factory in Jönköping, several thousand tons of peat powder fuel have been used in comparison with good English coal. It was found early in the tests that the balance between greater efficiency and the higher cost of thorough drying could be best settled by leaving 15 per cent of moisture in the peat powder. High-grade peat with this amount of moisture was found equal in fuel value to the best English coal. Second quality peat with 15 per cent moisture has a lower fuel value but is fortunately quite serviceable; its fuel ratio as compared with the best English coal is, according to Lieut. Ekelund, the Swedish inventor, 10 to 12.

Peat powder is used in Sweden at a cost of $1.75 per ton, including interest and sinking fund charges. It could be produced at not much more than this figure in the peat bogs of our Northern States and Atlantic Seaboard. In Sweden its advantages over good English coal, costing from $4.10 to $4.90 a ton, are fully recognized. In competition in this country, with hydro-electric power, producer gas and long distance electric transmission from central power stations, the advantages of peat powder loom up less conspicuously.

Process for Drying Raw Peat. E. Abresch, Neustadt, Germany. Br. Pat. 20,145, Sept. 11, 1911. The raw peat is mixed with hard dried compressed peat and the mixture is subjected

to a continuously and gradually increasing pressure. (From J. Soc. Chem. Ind.) H. P.

The Use of Peat on Danish Railroads. A. Ments. Hedeselskabets Tidsskrift, 1912, p. 13. H. P.

Stoking with Peat or Coal at the State Railroad Electric Station in Struer. J. Tylvad. Hedeselskabets Tidsskrift, 1911, p. 294 and p. 301. H. P.

Class III.—Peat Distillation and Coke.

Peat Coking. Chem. Ztg., 1912 (36) p. 239. The International Carbonizing Company of London, who have acquired the patents of the Chemist Ekenberg, have purchased a large peat deposit, of about 10,000 Tunnland (12,198 acres), at Dalamossen in Smaeland, Sweden, at the price of 12 Krone per one Tunnland (approx. $3.60 per acre). For the 3,000 Tunnland, which this same English company bought, last year at Dummossen near Joenkoeping, 30 Krone per one Tunnland was paid (approx. $9.75 per acre).

Nothing definite is known regarding the intentions of the foreign interests, who now own several large deposits in Sweden. At one time it was stated that a plant for peat litter was to be erected, at another time a peat coking plant, and later it was rumored that a new process for obtaining alcohol from peat was to be erected. H. P.

Peat Tars. Rud. Löbel. (Beiträge zur Kenntiss des Torfteers:) Hannover, 1911. (Techn. Hochschule dissert.) 44 pp. Thesis.

The Carbonization of Damp Peat Under Pressure. (Zur Druckverkohlung feuchten Torfs) Dr. Tacke. Mitt. Ver. Moorkulter. 1911, 21, pp. 429-34. 22, pp. 449-450.

Distillation of Peat, Lignite, Shavings, Etc., description of a furnace for. Prak. Mach. Karst. Mar. 18, 1909.

Coking or Carbonizing Peat, Wood, Etc. A. Wengler. Br. Pat. 12,738 (1911).

Same as Fr. Pat. 430,257.

See this Journal, Vol. 4, p. 194. H. P.

Production of a Solid Fuel Similar to Coal by Carbonization of Peat and Similar Combustibles. F. Fritz. Ger. Pat. 241,386. May 14, 1910. The peat is charged into a retort and gas from a second retort, heated externally, is passed through until the water and other valueless constituents have been expelled. The retort is then closed gas-tight and the charge left for a time to the action of its own heat (250°-300° C.). It is stated that a uniform coal-like mass is obtained which burns without production of smoke and possesses a high calorific value. (Jour. Soc. Chem. Ind. 31, (1912) :2 :63.) H. P.

Coking Peat. Chemische Fabrik Pluder. German Pat.

20,348 (1912). The dried material is treated in a direct-heated oven. The oven is brought down to a temperature where acetic acid begins to distil, for every new charge. The acetic acid distillation is allowed to take place without any further addition of heat, after which the coking takes place by the usual process. By this process a low consumption of fuel is required and the yields are both qualitatively and quantitatively higher than by the old process. H. P.

Class IV.—Peat Gasification.

The Power of Peat. The Irish Industrial Journal, 1911; Vol. 2 (No. 47), p. 9. The question of deriving power from peat has been one, perhaps, which has baffled scientists more than other simple-looking, ordinary, unattractive, everyday problem. The great difficulty lay in the drying of peat, so as to use it in the form of briquets. This process, which is known as the Stauber process, consisted in removing the water by means of compression and other drying methods. Up to the present all efforts to get water out of peat have proved so difficult and so costly as to remain a hopeless and insoluble matter.

A band of commercialists working on simple lines have succeeded, not in drying the peat, but in utilizing it in a damp condition, by feeding it into the hopper of a gas-producing plant. Rapidly the heat splits up the component parts of the water into oxygen and hydrogen gas. Thus, the very dampness of the peat assists the process of gas production. This simple fact is made use of by Messrs. Crossley, the well known gas-engine builders, who recently constructed the famous peat gas-producers installed so successfully at Mr. Hamilton Robb's factory, Portadown. In our last issue, we showed how successful the experiment was, and the low cost of production, which was less than half of that effected under the old coal system.

The great beauty of this method is that it entirely gets over the colossal difficulty of drying peat by scientific means. Of course, sun-dried peat is always available for firing. But, then, to control the sun and get it to shine on a regular system of shifts is evidently a task beyond the ken of man. No power on earth could produce a regular supply of sun-dried peat. Consequently, it has hitherto been unavailable for industrial purposes. But now that peat can be used in gas producer plants, built to use it economically up to 45 per cent of water, it is evident that the question is at last solved. Peat normally contains about 30 per cent of water, and this leaves a good margin for wet seasons. Of course, the higher the percentage

of water the less economical is the use of peat. There is no difficulty, however, in obtaining peat dried to the degree of 45 per cent of water, except under abnormal conditions.

The tar recovered from the extractor is a valuable by-product, worth about 35s. per ton, and as about 5 per cent is obtained from each ton of peat gasified, this effects a return of 30 per cent of the fuel costs, taking the cost of peat at 5s. per ton. The recovery of this tar goes on quite automatically, whilst the feeding of peat into the hoppers takes place about every hour, the operation being very simple, and in fact the entire plant of 400 B. H. P. capacity is attended to by one man.—H. P.

Engine Gas from Peat. U. S. Consular Report. (See also this Journal, Vol. 4, p. 200.) The production of gas from peat having a low water content (up to about 20 per cent), for use in suction gas (sauggas) engines has already met with considerable success in Germany, but for a number of years efforts have been made to utilize peat with a water content of as high as 50 to 60 per cent and thus eliminate the costly process of drying the raw material.

Difficulties have been encountered in preventing the loss of calories through radiation and other causes, and in getting rid of the dust and tar vapors carried over by the gases to the engine; but great strides have been made recently in overcoming these obstacles. Peat with a water content up to 60 per cent has been found to be a suitable fuel. Owing to its great porosity and low specific gravity it presents a large combustion surface in the generator, so that the oxygen in the air used as a draft can easily unite with the carbon of the peat.

One of the great difficulties is to eliminate the tar vapors that clog up many of the working parts of the engine. The passing of the gas through the wet coke washers and dry sawdust cleansers does not appear to have thoroughly remedied the evil. Efforts were therefore made to remove the tar-forming particles of the gas in the generator itself or to render them harmless. That of the Aktien-Gesellschaft Görlitzer Maschinenbau Anstalt und Eissengeisserei, of Gorlitz, was displayed at the exposition at Posen in 1911. The gas from the generating plant was employed in a gas-suction engine of 300 horsepower used to drive a dynamo for developing the electric energy for the exposition. The fuel used was peat with a water content of about 40 per cent. The efficiency and economy results obtained were very promising.

Design of the Generator—Advantages.

The generator consists of a vertical sheet-iron or steel cyl-

indrical furnace with double walls; it is about 12 feet high and the diameter is a trifle more than 6½ feet. The interior wall is lined with fire brick. The sides of the furnace are pierced with six slanting aperatures about 6 inches in diameter that may easily be opened or closed and serve for inspecting the interior combustion chamber and cleaning the fire. The fuel is fed into the furnace through a lid on the top of the cylinder; draft air enters through hollow cast-iron feet. In an opening in the center of the cast-iron bedplate there is fitted a cast-iron tube that extends below to the water in the foundation and above to the center of the combustion zone about where the peat is converted to ashes. At the bottom the tube is connected to a pipe leading to the scrubber through which the gas passes on its way to the engine.

The advtanges claimed for the Görlitz engine are that the sulphurous gases and those containing great quantities of tar products are drawn down by the suction of the engine through burning masses of peat and thus rid of their deleterious constituents. The air for cumbustion purposes is well heated before entering the combustion chamber, thereby producing economical results. It is claimed also that the gas produced by its system is so free from impurities that the cleaning and drying apparatus may be of the simplest kind.

The Gorlitz Engine—Cost of Power.

The engine exhibited at Posen by the Görlitz company was a double-working, four-cycle, one-cylinder suction gas motor, with a cylinder diameter of 25.59 inches, length of piston stroke of 29.53 inches, and diameter of piston rod of 6.7 inches. The piston is water cooled and provided with ribs that serve to direct the circulating water into the proper channels. All parts of the engine are easily accessible and all stuffing boxes are provided with metal packing. Probably the most notable feature of the Görlitz engine is the governor, which automatically admits the correct charge into the cylinder and maintains a proper mixture at all speeds and loads, even when the engine is running light. The governor is also connected with the igniting apparatus so that there is always a proper ignition.

The cost of the peat used (water content, 40 per cent), was $0.57 per metric ton (2,204.6 pounds). In two trials the consumption per kilowatt-hour obtained was 3.43 pounds for the first trial and 5.31 pounds for the second.

Peat Producer Gas. R. H. Fernald and C. D. Smith. Bulletin No. 13, U. S. Bureau of Mines. 1911. In the "Resumé of Producer Gas Investigations, Oct., 1904, to June, 1910, at the U. S. Government Stations," the authors show the possibility of using peat for power purposes, when so converted

by plants situated at the bogs. The average gas analyses for producer gas are given as follows:

	Up-draft producer	Down-draft producer
Carbon dioxide	12.4 per cent	10.94 per cent
Oxygen	0.0 per cent	0.41 per cent
Ethylene	0.4 per cent	0.06 per cent
Carbon monoxide	21.0 per cent	16.91 per cent
Hydrogen	18.5 per cent	10.19 per cent
Methane	2.2 per cent	0.66 per cent
Nitrogen	45.5 per cent	60.83 per cent

The average gas yields were as follows in an up-draft pressure producer: 30.3 cu. ft. gas per pound of fuel as fired, showing 175 B. T. U. per cu. ft. Based on dry fuel, 38.3 cu. ft. gas per pound of material would be obtained.—H. P.

Suction Gas Producer for Peat and Low Grade Fuels. Tonindustrie Zeitung, Vol. 35, p. 1280. A thermal efficiency of 92 per cent is claimed for the producer made by the Görlitzer Maschinenfabrik und Eisengiesserei. The fuel is fed in at the top and the air is partly drawn through a pipe which passes into the well where the warm water from the scrubber flows, then up through the fuel bed, discharging near the top. The rest of the air is drawn up through the annular space surrounding the producer, the producer having a double wall, and enters just above the fuel bed. The gas is drawn off near the bottom. All the air is pre-heated in the manner described and has to pass to the top of the producer and thence all the way down through the fuel bed.—H. P.

A Successful Peat Gas Power Plant in Ireland. Electric Review (London), Dec. 22, 1911, p. 1017. Ill. Also in Power, Jan. 23, 1912.

A German Peat Gas Power Plant. P. C. Percy. Power, Jan. 9, 1912. Describes the Heinz producer and Görlitzer gas engine.

Production of Electricity by Peat. E. Hoffmeister. Power, Feb. 9, 1909.

Power Gas Plant for Peat and Low Grade Fuels. Ton-Industrie, Dresden, Sept. 9, 1911.

Utilization of Peat Moors by the Production of Power Gas and Ammonia. A. Frank. Journ. Gasbel. 55 (1912), 49-53. The utilization of bogs through the generation of power gas and ammonia. According to Dr. Frank, the best utilization of the peat deposits is accomplished by gasifying the peat in the Mond type of gas producer, and recovering the ammonia from the gas. Peat may be used in this producer with a water content of from 50 to 55 per cent. About 70 per cent of the com-

bined nitrogen in the peat may be recovered as ammonia in scrubbing the gas. The following is the composition of the producer gas obtained: Carbon dioxide, 17.4 to 18.8 per cent; carbon monoxide, 9.4 to 10.0 per cent; hydrogen, 22.4 to 25.6 per cent; methane, 2.4 to 3.6 per cent; nitrogen, 42.6 to 46.6 per cent.

Peat Gas-Producer Enterprise. The Gas Engine, 14:3:151. March, 1912. Abstract from Mr. W. A. Beswick's letter to Engineering, relating to the European plants installed by Power Gas Co., Ltd., of Stockton on Tees.

An English Peat Plant. The Gas Engine, 14:3:151. March, 1912. Abstract from W. A. Beswick's letter to Engineering, quoting the part relating to an English gas-producer plant installed by the Power Gas Co., Ltd.

Engine Gas from Peat. Journal of Electricity, Power and Gas. 28:17:383. April 27, 1912. Discusses the Görlitzer gas-producer plant at the Posen Exposition, 1911. See pp. 54-56 of the present number of Jour. Am. Peat Soc.

Peat in Canada. The Gas Industry, 12:2:96. Feb., 1912. Outlines the work with the gas producer by the Dominion Department of Mines.

Class VII.—Peat Deposits and Soils.

Peat Utilization in Germany. Iron and Coal Trade Review, Vol. 83, p. 772. Germany has five million acres of marsh land. The best German air-dried peat is stated to contain 45 per cent carbon, 0.5-50 per cent ash and 25 per cent moisture. Frank and Caro's process is supposed to produce a good quality of gas using 60 per cent moisture in the original peat. Eighty-five per cent of the nitrogen is recovered as ammonium sulphate. H. P.

The Development of Marsh Soils. A. R. Whitson and F. J. Sievers, Bul. No. 205, Wis. Agr. Exp. Sta. (Feb., 1911.) (Abstract.) Wisconsin marsh lands comprise 2,500,000 to 3,000,000 acres, some of which lie in large marshes of 25,000 to 50,000 acres, but a large part is in small tracts. Through proper drainage and soil management, much of this land can be made very productive and will add greatly to the farm area of the state.

The chemical composition and the possibility of thorough drainage are the chief factors which determine the value of marsh lands for cultivation.

The drainage of marshes is the first step toward inprovement.

Proper tillage of marsh lands is of the utmost importance. Heavy rolling, by packing the loose peat soil, produces a firm seed bed which is better adapted to cultivated crops, especially small grains, than the loose material.

Fertilization of marsh soils is important, on account of the unbalanced condition of the elements which they contain. Marsh soils are excessively rich in nitrogen, but are frequently deficient in phosphorus and potash. While barnyard manure will supply the last two elements, these can be supplied in commercial fertilizers, allowing the use of the barnyard manure on upland soils where its nitrogen as well as its mineral elements are needed.

Acidity develops in marsh soils quite commonly where lime carbonate is not brought in from surrounding higher land. This acidity, however, does not interfere with the growth of crops provided the soil is properly fertilized.

The crops best adapted to marsh lands include corn, potatoes, cabbage, buckwheat, and timothy and alsike clover for hay. When the soil is thoroughly firmed by rolling, small grains can be grown, of which wheat and barley are best, with oats and rye second. Excellent tame grass pastures can be developed on these marshes with proper care. C. A. D.

Class VIII.—Peat Drainage.

Drainage of Marshes. Geo. M. Warren. U. S. Dept. of Agriculture. Office of Exp. Stations. Bulletin No. 240, 1911. This bulletin clearly sets forth the field work undertaken by the Government in reclaiming tidal marsh land. The construction of drainage work by building levees, ditches and sluices, and drainage by pumping, are clearly and fully described, and accompanied by illustrations, diagrams, and maps. H. P.

Drainage Reclamation. F. L. Bolton. The Michigan Technic, 1912, p. 49. The possibilities of reclaiming swamp and overflowed lands is discussed in detail, with special reference to dike work. A general idea of costs is also included. H. P.

Class X.—Peat Fertilizers.

Manuring Experiments with Peat. A. I. Dreiman. Zemledielets, 1910. No. 3. Peat alone nearly doubled the yield of barley in sandy soils, but peat in combination with Thomas slag, potassium salts and sodium nitrate gave smaller yields than a complete mineral fertilizer alone. (From Chem. Absts.)
H. P.

Class XII.—Miscellaneous Abstracts.

Syndicate for the Utilization of Peat. The Chemical Trade Journal, Vol. 49, p. 576, writes as follows: The Manchester Guardian of Wednesday last contained the following note re-

lating to the proposed syndicate for the utilization of peat: The latest example of Mond enterprise is the Ammonium Finance Syndicate, Limited, with a capital of £200,000 in £1 shares, for the applications are now being privately received. The directors are Robert Ludwig Mond, Emile S. Mond, Robert Armitage, and Robert Mathias, and the list of first subscribers is: Estate of the late Dr. Ludwig Mond, £50,000; Sir A. Mond, Bart., M. P. £20,000; Robert Mond, £10,000; Emile Mond, £5,000; Robert Armitage, M. P., £5,000; Robert Mathias, £3,000; W. A. Saxton Noble, £5,000; directors of Power Gas Corporation and various applicants, £10,700, making a total of £108,700, or 54⅓ per cent of the capital. The objects are to acquire control of collieries in Natal, coal deposits in South Manchuria, and peat deposits in Florida and Italy, and to establish there ammonia-recovery gas plants in co-operation with other capitalists. Large profits are anticipated, particularly from the sale of sulphate of ammonia. H. P.

DEPARTMENT OF THE INTERIOR.

Bureau of Mines.

NEW PUBLICATIONS. (List 12.—August, 1912.)

Bulletin.

Bulletin 18. The transmission of heat into steam boilers, by Henry Kreisinger and W. T. Ray. 1912. 180 pp.

Technical Papers.

Technical Paper 17. The effect of stemming on the efficiency of explosives, by W. O. Snelling and Clarence Hall. 1912. 20 pp.

Technical Paper 18. Magazines and thaw houses for explosives, by Clarence Hall and S. P. Howell. 1912. 32 pp., 1 pl.

Technical Paper 23. Ignition of mine gas by miniature electric lamps, by H. H. Clark. 1912. 5 pp.

Reprints.

Bulletin 40. The smokeless combustion of coal in boiler furnaces, with a chapter on central heating plants, by D. T. Randall and H. W. Weeks. 188 pp. Reprint of United States Geological Survey Bulletin 373, revised by Henry Kreisinger.

Technical Paper 21. The prevention of mine explosions, report and recommendations by Victor Watteyne, Carl Meissner, and Arthur Desborough. Reprint of United States Geological Survey Bulletin 369.

The Bureau of Mines has copies of these publications for free distribution, but can not give more than one copy of the same bulletin to one person. Requests for all papers can not be granted without satisfactory reason. In asking for publications please order them by number and title. Applications should be addressed to the Director of the Bureau of Mines, Washington, D. C.

BY-LAWS

The Committee appointed by the Kalamazoo meeting has drawn up the following by-laws, which will come up for action at the 6th annual meeting:

I.—GOVERNMENT.

Section 1. The Executive Committee shall have general charge of the affairs, funds and property of the Society, and of all other matters not otherwise herein provided for.

Sec. 2. Meetings of the Committee shall be held upon the call of the President of the Society, or upon the request of two members of the Board, and a quorum shall consist of three members.

Sec. 3. The Executive Committee shall pass upon the qualifications for admission of membership to the Society. It shall have the power to suspend or expel any member of the Society by a majority vote of the whole Board. It shall also act upon any resignations of membership.

Sec. 4. The Executive Committee may fill any vacancy in its body by the election of any member of the Society, who shall serve until the next annual election.

II.—DUTIES OF OFFICERS.

President.

Section 1. It shall be the duty of the President to preside at all meetings of the Society. He shall be chairman of the Executive Committee, and he shall with the Secretary-Treasurer, or in his absence with the First Vice-President, sign all written contracts and obligations of the Society.

First Vice-President.

Sec. 2. It shall be the duty of the First Vice-President to act in the absence or disability of the President. He shall also be a member of the Executive Committee.

Second Vice-President.

Sec. 3. It shall be the duty of the Second Vice-President to act in the absence or disability of the President and First Vice-President. He shall also be a member of the Executive Committee.

Secretary-Treasurer.

Sec. 4. The Secretary-Treasurer shall keep the minutes of all meetings of the Society and of the Executive Committee; he shall notify members of their election, issue notices of all meetings, conduct the correspondence, keep the records of the Society, collect all moneys due the Society and perform such other duties as may be assigned him by the Executive Committee. He shall deposit all moneys due the Society in such institutions as may be authorized by the Executive Committee. He shall pay all bills approved by the Committee, and shall make a report to that body when so requested. He shall present at the annual meeting a written statement of the financial condition of the Society.

III.—COMMITTEES.

Section 1. The President of the Society or the Executive Committee may appoint such committees as may be deemed necessary or advisable for the benefit and interests of the Society, and determine the scope of their work.

IV.—MEMBERSHIP.

Section 1. Candidates for membership in the Society shall be proposed by one member, in writing.

Sec. 2. Nominations for Honorary Membership shall be made by the unanimous vote of the Executive Committee.

Sec. 3. A member-elect who fails to pay his dues within sixty days from the date of his election, thereby forfeits his right to qualify, unless permitted to do so by vote of the Executive Committee, after the payment of the proper dues has been made.

V.—DUES.

Section 1. The membership dues shall be five dollars per year or as provided by the Constitution.

Sec. 2. Members elected within two months of the time when the annual dues are payable, shall be exempt from the payment of the dues for the current year.

VI.—MEETINGS.

Section 1. The date of the annual meeting of the Society for the election of officers and the transaction of other business, shall be fixed by the Executive Committee.

Sec. 2. Other meetings of the Society can be held at the call of the President or of the Executive Committee or upon written request of five members in good standing, addressed to the Secretary-Treasurer. Notice of such meeting shall be mailed to each member at least seven days before the date of the meeting.

Sec. 3. At the annual meeting twenty members shall constitute a quorum, and at other meetings, fifteen members.

VII.—PUBLICATIONS.

Section 1. The Society shall publish a Society organ, the same to be edited and published as the Executive Committee shall provide.

VIII.—SECTIONS.

Section 1. Whenever twenty or more members located in any part of the world shall so desire and shall secure permission of the Executive Committee, they may organize a Section, to be presided over by a chairman and may hold meetings at such times as may be decided upon by a majority of the members of the Section. The expenses of such meetings, not exceeding 20 per cent. of the amount of the membership fees paid in by the members of the Section, shall be paid from the general funds of the Society, on presentation of itemized accounts of all expenditures.

IX.—AMENDMENTS.

Section 1. These By-Laws may be amended by the votes of two-thirds of the members of the Society present at any meeting, provided that the proposed amendment shall have been approved by the Executive Committee and mailed to every member at least ten days before the meeting at which it is to be considered.

The 6th Annual Meeting

of the

American Peat Society

will be held at

Columbia University

New York City

Saturday, September 7th, 1912

Program

After a business meeting at 9 o'clock there will be papers and discussions on the following subjects:

1. Address by the President.
2. Peat in Agriculture—(a) Drainage and Development of Peat Bogs. (b) What Has Been Done in the United States in the Recovery of Land From Peat Swamps, and What Are the Principal Products for Cultivation.
3. Standard European Method of Preparing Peat for Fuel.
4. The Preparation of Peat Bogs for Exploitation as Sources of Fuel or Power.
5. Preparation and Use of Powdered Peat for Fuel.
6. The Peat Fuel Work of the Canadian Department of Mines.
7. Mechanical Excavators for Peat Fuel Production.
8. The Use of Peat Fuel in Gas Producers.
9. Driers for Artificially Drying Peat for Fuel and Fertilizers.
10. A Successful Peat Fuel Plant.
11. Peat By-Products.
12. Progress in Peat Utilization Abroad.

Privileges have been granted by the Chemists' Club to the members of the American Peat Society to use the Club Library at 52 East 41st St., New York, provided they are supplied by cards of identification. Such cards will be issued by the Secretary to any member wishing to use the library.

Headquarters will be at Chelsea Hotel, 222 West 23d St., New York.

Journal of the American Peat Society

VOL. V | JULY, 1912 | No. 2

PEAT BOGS IN MICHIGAN—FROM AN AGRICULTURAL POINT OF VIEW.

By Professor A. J. Patten, Michigan Agricultural Experiment Station, East Lansing, Mich.

(Read at the Kalamazoo Meeting.)

The study of the agricultural uses of peat is one in which I have been interested for several years and about four years ago we first began, in the laboratory of the Michigan Experiment Station, an investigation of the nature of the nitrogeneous compounds in peat soils. This work was first started by Dr. Jodidi and has since been carried on by Mr. Robinson.

While we cannot make any claims, as yet, to any startling discoveries, we believe that we are learning something every day and that the results of our labors will ultimately be of great practical benefit.

According to Davis, the peat-bogs of Michigan comprise about one-seventh of the total area of the state, and when we consider the high percentage of nitrogen they contain, it will readily be seen that a large amount of energy is thus potentially stored up, that could and should be used for the production of crops, if only we learn how best to use it.

According to analyses made in our laboratories, the air-dried peat contains approximately 2.50 per cent. nitrogen. This means an amount of nitrogen per acre-foot, over the total area, equivalent to 202,800,000 tons of nitrate of soda, which, at $50 per ton, would represent a cash value of $10,140,000,000—a figure which is not insignificant when compared with the value of some of the mineral deposits of the state. Stated in another way, this means an amount of nitrogen sufficient to furnish

yearly, 100 pounds of nitrate of soda per acre to the 12,000,000 acres of farm lands in Michigan, for a period of 338 years.

The utilization of this vast amount of nitrogen for agricultural purposes has received the attention of experimenters for generations, but today only a very insignificant proportion of the swamp lands are being used.

The character of the peat-bogs varies considerably in different localities and the use to which the peat may be subjected depends very largely upon its texture and quality.

In order to bring this matter before you I propose to discuss the subject assigned to me under the four following heads:

1. As a direct fertilizer.
2. As filler for commercial fertilizers.
3. As stable litter.
4. As an agricultural soil.

Peat as a Direct Fertilizer. Upon first thought it would be natural to suppose that peat might be profitably used as direct fertilizer to supply nitrogen to the upland soil, since it contains, when in the air-dried state, a comparatively high percentage of this element. The great majority of commercial fertilizers sold in the state contain less, and the best grades of bone meal contain about the same amount.

Commercial forms of plant food should, however, possess a high availability and in this respect peat differs from the ordinary materials used for this purpose.

Figures obtained at the Michigan Experiment Station indicate that the nitrogen of dried peat possesses an availability ranging from 25 to 30 per cent. These figures are in accord with the results obtained by other experimenters and they have been verified by actual vegetation tests using peat as the source of nitrogen as compared with nitrate of soda and other well known nitrogenous materials.

Therefore, considering the low availability of the nitrogen of the peat and the rather large bulk of the material, we must come to the conclusion that it is not a profitable source of commercial nitrogen. Good results have been reported in many cases by adding peat to light sandy soils to supply organic matter, but this could not be profitably accomplished except where the peat bog is adjacent to or near by the soil to be treated. One could not afford to purchase peat for this purpose, as the organic matter could be more economically grown on the soil and then turned under.

Peat as a Filler for Commercial Fertilizers. During the past few years peat has been used to some extent as a filler by the manufacturers of commercial fertilizers. It works admirably for this purpose because, owing to its great absorbing

powers, it takes up any excess moisture in the fertilizer and consequently greatly improves the physical condition of the mixture. Fertilizers containing peat filler drill easily and they are, on that account, more easily applied to the land than fertilizers that cake and become hard. Peat also absorbs odors as successfully as liquids, and consequently fertilizers containing peat filler ars much less objectionable to the olfactory nerves than ordinary brands.

When used in this respect peat should be considered simply as a filler and its nitrogen should not be considered in making up the formula. Many states have legislated against its use as a source of nitrogen because of the low availability of the element. Some fertilizer manufacturers using peat filler claim that it gives to the fertilizer an added value due to the humus added to the soil by its use, but when we stop to consider that the average farmer does not use over 200 pounds of fertilizer to the acre, and further that certainly less than 1,000 pounds of peat are used in each ton of fertilizer, it is hard to conceive how an amount of humus so added could ever accomplish much good. The fact remains, however, that both from the manufacturer's and the consumer's point of view, peat is an excellent material for use as a filler when such is necessary.

Personally I would never recommend the purchase of fertilizers containing filler because every pound of filler added increases so much the cost of the actual plant food. A farmer cannot afford to pay fertilizer prices for filler.

Peat as a Stable Litter. The preservation of the farm manures is a subject that many farmers give but slight attention to, little realizing that the most valuable part of the manure goes to waste. By far the larger amount of the nitrogen excreted by the ordinary farm animals is voided in the urine, and unless precautions are taken to preserve the liquid a valuable part of the manure is lost forever. The ordinary materials used as litter are not good absorbents and consequently do not accomplish this very successfully. Peat answers the requirements for this purpose admirably, and being itself rich in nitrogen would increase materially the value of the manure. Then, too, the decomposition of the manure induces a like process in the peat which increases the availability of the nitrogen. Air-dry peat will absorb about three times its weight of liquid manure without becoming mushy and pasty, and when this is allowed to dry in the open air all of the nitrogen is retained. If, however, it is subjected to artificial heat during the drying, a large percentage of the nitrogen of the manure will be driven off.

Peat would make an excellent litter in dairy stables, as it

would absorb the odors and thus tend to "sweeten" the stable. Also the cattle yards, which on many farms are a disgrace, could be kept "sweet" and clean by the use of a few loads of peat throughout the year. Many of the farms of the state have peat bogs of more or less extensive areas and it would seem good economy to use this peat for bedding and sell the straw.

Formerly the practice of composting peat with the manure was followed quite generally, but in later years it has been abandoned almost entirely, and I often wonder if we have been wise in doing so. Possibly the great increase in the use of commercial fertilizers has been in part responsible for the disuse of the practice. It is a well established fact that the use of commercial fertilizers alone will not keep a soil in good physical condition, their constant use soon exhausts the soil of its organic matter and unless measures are taken to keep up the supply, the soil becomes hard and cloddy, loses to a great extent its moisture-holding capacity and its friability. Consequently its producing capacity is lowered. But few farms produce barn manure enough to keep the soil in good physical condition, but those farmers who have a peat deposit on their farms could double the quantity and greatly increase the value of their manure by using peat in the stables and for composting.

Peat as an Agricultural Soil. It is, however, as an agricultural soil that peat will yield the greatest revenue, for the returns will be continuous. Wherever peat bogs of the right character can be successfully drained they may be brought under cultivation and made to yield large returns upon the investment. This fact has already been demonstrated many times. The celery soils on the outskirts of this beautiful city are without question the most valuable agricultural lands in the State of Michigan. The same is true of other states where such soils have been utilized for growing truck crops. In many sections of New York State the price of these soils has jumped in a few years, from $10 to $15 per acre to, in many cases, $300 per acre.

Greater care is required in the management of such soils than is usually demanded by the common agricultural soils. This is especially true in regard to drainage. The water-level generally stands very near the surface, making what is termed a "cold" soil. Ditching must be resorted to in order to lower the water to a proper level. Great care must be exercised, however, that the draining be not too efficient, for an over-drained peat or muck soil becomes dry and powdery and incapable of supporting vegetation.

It is not expected that all peat bogs can be transformed into

agricultural lands. Some on account of location cannot be successfully drained, some on account of the character of the peat are not adapted to growing crops. However, there are within the state thousands of acres of land that can be brought under cultivation at a comparatively low cost.

The range of crops that may be successfully grown on peat soils is possibly less than upon the upland soils, but they are especially adapted to growing such crops as celery, onions, head lettuce, melons, etc., and these are ranked with the best money crops.

But little experimenting has been done upon this class of soils as to best methods of cultivating, fertilizing, etc., although it is generally conceded that they are, as a rule, deficient in the mineral elements of plant-food, phosphoric acid and potash. While the nitrogen of peat is considered unavailable when used as a direct fertilizer, it probably will become available under cultivation, sufficiently rapidly, to supply the needs of most crops for a good many years.

In considering the vast problem of the conservation of our natural resources the question of conserving the peat bogs for agricultural purposes should receive critical attention.

Peat Poetry. The following appeared in the Chicago Examiner a few weeks ago, and will appeal to many of those who have enjoyed peat fires, especially in the open air:

Peat Reek.

The scent of the rose is blithe and fair,
And sweet is the lily-laden air,
But there's a smell that is sweeter far—
The smell of the guid peat reek.

The bluebell's e'e is a bonny hue,
An' the distant hills hae heaven's blue;
But there is a color I'd rather view,
In the tint of the curling reek.

There's mony a fire gi'es a fiercer heat,
An's better to burn than the lowly peat;
But nane hae mem'ries half sae sweet
As the glow o' my ain fireside.

—A. M. Wood.

RECENT PROGRESS IN PREPARING PEAT FOR FUEL.

Charles A. Davis.*

(Read at the Kalamazoo Meeting.)

For many years the great stores of fuel in the peat bogs of Northern Europe have been utilized in a small way, as sources of domestic fuel. More recently, as industrial developments have increased, deposits of this kind have been looked upon by their owners, both in Europe and America, as potential sources of great wealth, if they could be converted into fuel for producing power certainly and cheaply, so that large and steady production could be assured.

The principal bar to successful large production is found in the fact that the raw material, in undisturbed deposits has from 85 to 95 per cent. of water intimately mixed with it; this water must be dug and handled to secure a relatively small proportion of salable or usable material, which nevertheless, must be sold at a very low price to compete with coal and other fuels that are already on the market, at generally satisfactory prices.

Notwithstanding these facts, many hundreds of thousands of dollars have been spent in developing plans and plants for mechanically handling raw peat, wet as it lies in the bog, by methods that experience and practical knowledge would have shown were impracticable for more than one reason.

It is unnecessary here to more than mention the extensive tests of methods of forcing the surplus water from peat by pressure developed by hydraulic and other presses, undertaken on a large scale by the German Government; of the attempts to use centrifugal machines, with and without electrical action, both experimentally and in actual plants designed and built for commercial production; of the plants using various types of briquetting machines and complicated and costly mechanical devices for drying peat and pressing the dry peat powder thus obtained into compact and attractive form; of other devices, more or less complex, that have been proposed, or really developed, for utilizing well-known, or new, machinery or processes for the purpose of making peat fuel.

True progress in any art lies generally in the directions of simplicity, directness and efficiency. This is especially true of the mechanic arts, and, from experience it would seem that the art of making peat into fuel was no exception, as we follow the swing of the pendulum from one side to the other. In early days the methods of preparing peat for use were of the simplest

*By permission of The Director, Bureau of Mines.

possible nature; then more complicated ways were developed, introducing machinery, which gave greater output; still more complicated methods were then worked out and tried but for various reasons were found unadapted to the raw material and, at present, the tendency is towards simplicity again, but simplicity in machinery, for replacing hand labor.

Since there has never been in North America a really profitable production of peat fuel, we cannot justly expect the most significant advances to have originated there and we are therefore compelled, as always, to refer to European developments of the latest phases of real progress are to be recorded. By "real progress" is meant, I may say, that which has proved itself such in actual commercial plants.

The most striking progress that can be reported at this time in the use of peat fuel is in the gas-producer, where, from present indications, it finds its greatest possibilities and most important use in the production of power.

It is now apparently beyond question that internal explosion gas-engines may be most advantageously used for the generation of power to any extent desirable. The gas for such engines may be of the poorest grades and be generated from the lowest grades of fuel, provided it is delivered to the engines in proper quantities and of reasonably uniform composition; this is now thoroughly demonstrated by the installation of the U. S. Steel Company at Gary, Indiana, which it is reported will soon develop the enormous amount of 150,000 horse power by gas-engines alone, operated on blast furnace gas, a type of gas of such low fuel value that most of it was formerly wasted even in well constructed plants.

The size of the individual gas-engine has also been so rapidly increased that where five years ago engines of 500 horse power were considered very large, at the present time, at one of the large steel plants near Chicago, three gas-engines of 4,000 horse power each are being erected. These engines will each weigh when completed 1,840,000 pounds or 920 tons; the cylinders of these monsters are each 44 inches in diameter and weigh 70,000 pounds apiece; they will be operated with blast furnace gas, and generate electricity for use about the plant.

Large gas producer plants are much more common in Europe than in this country, but only mechanical engineers closely following their development know how rapidly the gas producer and gas engine are replacing the steam boiler and engine in industrial works and power plants in the United States, or realize how certainly this replacement will continue.

In order to have the matter clearly in mind, it may be well to say that a gas-producer is a special type of furnace in which

a part of the fuel in a very thick fuel bed is completely changed into carbon dioxide, an inert gas, and water, with the development of heat. This heat converts the rest of the fuel into gases which still can combine with the oxygen of the air and give off heat in burning, so that they have fuel value, and may be burned in any form of burner; or when mixed with air and ignited in a confined space, as in the cylinders of a gas engine, they combine with oxygen with explosive violence and move the piston. Producer gas is a mixture of several gases of which carbon monoxide and hydrogen are the most important, although nitrogen and carbon dioxide, both inert, are always present, the former in large percentage. Dust, tarry compounds and ammonia are also present and, before the gas can be used to best advantage, in gas engines, the tar and dust must be removed; this is done by passing the gas through "scrubbers," chambers filled with wet coke or other absorbent material, placed between the producer and the engine. The ammonia given off may be obtained as the sulphate by passing the gas as it comes from the gas-producer, through a special chamber, where it is brought into contact with sulphuric acid.

In Europe, especially in England, very large power and industrial plants within the past few years have been equipped with gas-producers of the Mond type, which make special provision for the recovery of the ammonia in the gas generated and are adapted to use in low grade fuels. The essential differences between the Mond producers and others, lie in the relatively large amount of steam introduced into the fuel bed to control the temperature and prevent, in large degree, the decomposition of the ammonia after it is formed.

Nearly a hundred plants of this kind are now in use in various parts of the world, ranging from one of 100 horse power, consuming but a ton of coal a day, to those developing 30,000 horse power, with a coal capacity of more than 300 tons of coal daily; about 20 of these plants exceed 5,000 horse power. The gas from these producers is used for practically every purpose for which fuel and power can be required in quantity, as the following list of industries in which gas-producers of this type have been successfully installed will show. The gas is used as fuel in iron and steel works, foundries, shipbuilding and engineering plants, metal-working and glass-making establishments, galvanizing, chemical, salt and white lead works, fire-clay, china and earthen-ware factories, textile mills, etc. For the production of power, Mond gas in gas engines is already used in machine and railroad shops, central electric stations, for power and lighting, electric railroads, flour and paper mills and mines, as well as in less important industries.

It is pertinent here to inquire what all of this has to do with progress in making peat fuel: simply, that the makers of the Mond gas-producers, who have been so successful with their installations for other kinds of fuel, and have been able to demonstrate so thoroughly the practicability of the application of producer-gas to both fuel and power uses, now announce that they have perfected a type of gas-producer and ammonia recovery plant for using peat, and after several years of experimental work have five installations of various capacity now in operation, two in England, one in Italy, one in Russia and one in Germany, in which peat containing 60 to 70 per cent. of water has been used successfully, and from which sulphate of ammonia has been recovered as a by-product, in amounts ranging from 70 pounds per ton of theoretically dry peat gasified, where the peat contains 1 per cent. of combined nitrogen to more than 200 pounds per ton where the nitrogen runs up to 2.3 per cent. as a result of plants of this kind operating efficiently, the claim is made by the Power-Gas Corporation, Limited, that "so great are the profits obtainable that it is often possible, while taking no credit whatever for the value of the power gas, to obtain as much as 100 per cent. profit from sulphate of ammonia alone, after making proper allowance for the cost of digging the peat, bringing it to the plant and for labor, stores, capital, shares, etc. Indeed, with peats comparatively poor in nitrogen, it is possible, in many cases, to produce the gas for nothing, the cost of power being then merely that of operating the gas engines, together with capital charges on the same. While these claims may be optimistic, it is evident that if 200 pounds of ammonium sulphate can be recovered from every ton of theoretically dry peat fired, and the same material yields 90,000 cubic feet of gas having a calorific value of 134 B. t. u. per cubic foot, the output of ammonium sulphate from a plant developing 1,000 horse power would be more than a ton per day, worth somewhere about $55 to $60 per ton at the plant.

American peats often run quite high in combined nitrogen, for example, 20 analyses of samples from Ohio, chosen at random from a series of reports on the water free basis, gave an average of 2.79 per cent. nitrogen; the highest of the series being 3.39 per cent., the lowest 2.22 per cent.; not all of our American peats, however, run as high as these. The fact that the peat can be used with so high a moisture content in gas-producers of this type makes an important advance and renders the possibilities of supplying a large plant with peat fuel alone much more certain than if the peat has to be more nearly dry, and would make it possible to dig the material throughout the year and dry it sufficiently by pressure, if this became necessary.

These claims have been made before, and are undoubtedly similar to those of Drs. Frank and Caro, but they are now backed by a strong corporation and, seemingly, by long experience. In the meantime, there come equally positive assurances from the German inventors that their plans are also certainly successful, and that plants will soon be operated in Germany by their system. If the persistent claims of success of both parties are capable of being substantiated, as doubtless they are, we shall indeed soon see advances in the peat fuel industry, and a wide use of peat for generating power and as a source of ammonia.

Within the past year, announcements have come from the most reliable sources that the production of peat powder on a large scale and its use as fuel has been at last perfected by Lieutenant H. Ekelund, at Back, Sweden. The processes of manufacture consist of digging the peat, spreading and drying it out of doors, on the bog surface, until it is dry enough to store, i. e., containing 20 to 40 per cent. of moisture. The peat blocks are then gathered, taken to storage sheds, and, as needed, this raw material is ground into very fine powder by mills developed for the purpose, dried in special drier to a moisture content of 10 to 15 per cent. and sacked for shipment in water-proof bags.

It is claimed that if fired by the method developed by Ekelund, peat powder prepared in this way is as efficient fuel, pound for pound, as the best English coal and can be produced at Back at less than half the cost at which coal can be bought. The improvements developed at Back that are of general value to all interested in peat fuel production, are mechanical digging and spreading devices of large capacity, simple and efficient construction, and economical in operation; these are supplemented, in the factory, by an automatic mechanical plant for handling the peat after it is once stored, so that it is moved to the grinding mills and from them to the drivers, and sacking bins, without manual labor. The special plan of firing the peat powder as fuel for boilers and heaters is simple in operation, is easily controlled and in its results is reported as entirely satisfactory. The plant at Back now has capacity for producing about 10,000 tons of dry peat powder annually and the cost of production from tests reported to the Swedish Government is 8.5 kronner per ton, about $2.30, all charges for interest, etc., included.

This development is of considerably more interest than it would be, if it were not known that powdered coal is already in commercial use as fuel in a number of industries in the United States, and also that powdered peat is being produced in the country in the amount of more than 25,000 tons annually for fertilizer filler, etc., although not in most cases at a cost so low as that reported. The advances made by Lieutenant Ekelund

should be followed up in the United States by those interested, for the powdered fuel has many special uses as well as its general application, that warrant a careful study of its production.

Our American students of the peat fuel industry of Northern Europe have always maintained that it would be impossible to make machine peat in this country, as it is made there, because of the greater cost of labor here. Therefore no earnest attempts have been made in the United States to produce machine peat by strictly following European methods, although in the aggregate thousands of dollars have been spent in developing so-called new and improved methods of making this product. The writer has always contended that, until the matter was really settled by actually trying under the best possible conditions, the question was an open one. It was with the greatest interest, therefore, that he examined the demonstration work on peat of the Canadian Department of Mines under Dr. Eugene Haanel, Director of Mines, and his able corps of special assistants in this department of his work. As is now known to most of those present, machinery of thoroughly proven efficiency was imported from Sweden, set up on a large bog at Alfred, near Ottawa, part of which had been bought for the purpose, and operated exactly as it would have been in Sweden, under a superintendent who had been thoroughly trained abroad in all of the details of this business. The bog was drained and the surface leveled and cleared of brush and other obstructions, and last summer the plant was operated for part of the season exactly as if it were to be a commercial operation. The digging was all done by hand and laborers were paid about the price that they would have received in this country; indeed they were paid rather more than the current rates for the same class of work in many parts of the United States, and yet the cost of production of the peat fuel ready for storage under these conditions was about $1.00 per ton exclusive of "overhead" charges. These, because of limited production both in time and quantity, were abnormally high, since the output could have been more than doubled with but small addition to these charges. It is apparent, therefore, that if the best type of peat machinery is imported from Europe and the plant and men are managed by properly trained and experienced superintendents, properly supported by capital, the production of machine peat fuel by the European methods can be made a success in the United States. This has not been demonstrated before and is undoubtedly the most important practical advance made in peat fuel production on this continent up to the present time.

The fact that this demonstration has been made does not indicate, however, that the tried and proven European methods

should be rigidly adhered to after something better has been developed. There is no reason why, for example, hand-digging should be insisted upon, now that mechanical excavators have been tested and shown to be adapted at least to some types of bogs. During 1910, it was announced that the Anrep excavator was given a final season's testing under commercial conditions and was finally pronounced ready to put on the market and can now be purchased. This excavator differs from that used by Ekelund in being of especially light and strong construction. It also leaves the walls of the openings made in the peat with such a slope that caving and breaking down are avoided. The capacity of this digger is about 43 tons of wet peat, 85 per cent. moisture, equivalent to 8 tons of salable fuel per hour; but one man not required for the engine and other machinery used where hand digging is employed is needed to operate the digger.

Such a machine coming from one who is perhaps the leading inventor of peat fuel machinery of Europe is certainly worthy of being tested under American conditions, and its appearance on any market must be considered a very substantial advance and one that is calculated to make the practical development of our own peat fuel resources the easier, because it removes the bugbear of "too much hand labor."

During the past two or three years there has been operated in Oldenburg, Germany, a combined excavating, macerating and spreading mechanism which moves along a tramway by its own power, as it digs, grinds and lays out the peat. This is the invention of Dr. Wielandt, who uses it to prepare the machine peat needed in a large peat coke and by-products plant at Oldenburg.

In passing, it may be said that, so far as has been learned, there has been no recent advance made in the processes of making peat coke and the recovery of by-products since financial reverses overtook the great plant at Beuerberg, Bavaria, developed by Dr. Martin Ziegler. The Wielandt peat coke plant at Oldenburg, Germany, although built on similar lines, is less costly and complicated, but few details relative to it have been published.

In the United States during the past year, three interesting experimental plants have been developed. The simplest is that built by the Peat Engineering Company of Toledo, Ohio, and operated for a short time during the past summer. This, in brief, is a small, compact, complete plant for digging, making and spreading machine peat, which is automobile and requires no track on which to run, as it is supported on a traction platform, which, in effect, is an endless belt of stout oak planks

passing over and under the wheels on which the plant moves, thus always giving a broad base for their support.

The digging and macerating is done in this plant by two large augers located at the rear end, incased in steel tubes and revolving in opposite directions. They remove the peat, reduce it to a pulp and deliver this to the spreader which is attached to one side of the platform. This spreader is exactly similar to successful European types, except that it is planned to mark the spread peat both lengthwise and crosswise instead of only one direction. A detachable turning and collecting device completed the plant. The motive power used on the first of these plants tested was electricity, delivered through a trailing conductor, but it could as easily be furnished by a gasoline or steam engine, as no very considerable horse power is required for the purpose.

A very similar self-propelling movable plant, but differing in having a chain and bucket excavator, and a standard type of European peat-pulping machine for macerating the peat, was tested near Farnham, Province of Quebec, Canada, in the summer of 1910, by the Company now known as the Peat Industries, Limited. The method of supporting this and of moving it was another adaptation of the well-known movable platform already described, which, in its application to agricultural machinery, is called the "caterpillar traction" device. This plant had the excavator on the right side of the supporting platform and the spreader and cutting machinery trailed behind. The motive power for propelling the plant and for driving the digging and macerating machines was furnished by a gasoline engine placed on the forward part of the platform or car.

The excavator cut a narrow, deep ditch, which could be macerating machine; this, after reducing it to pulp, delivered stumps and roots of trees, with which it came in contact in the peat; the depth of the cut and the speed with which the peat was delivered could be regulated by raising and lowering the free end of the cutter. The peat was dropped from the buckets of the cutter into a hopper, from which it was automatically and rapidly removed by a conveyor, running crosswise, to the macerating machine; this, after reducing it to pulp, delivered it by gravity to the trough-shaped hopper of the spreader, through the bottom of which it was forced out onto the surface of the bog over which the machine had just passed. The spreader smoothed the surface and cut it into parallel strips and cross-marked these so that the peat during drying broke upon into regular rectangular blocks the size and shape of common bricks.

The first of these mechanical plants could be operated by one man or by a man and a boy; the second easily by two men and a boy, the chief duty of the latter being to prevent

large roots and pieces of wood being carried to the macerating machine. The capacity of these machines was large enough to insure satisfactory commercial production and both gave much promise of future usefulness, when the ideas embodied in them were finally perfected. Both companies announce improved forms of the self-moving plants for the coming year, and their appearance is watched for with great interest, as is also the results of their performance under test conditions, as they promise real advancement in the production of peat fuel for all purposes in this country.

Another potentially valuable, simple and effective peat machine was tested in 1909 at Bancroft, Mich., by Mr. P. Heseltine, who has since modified and improved its construction, and planned to make it the center around which a light and simple mechanical plant is to be constructed; of the late development of these plans nothing can be said at this writing, but they will undoubtedly be given a thorough trial in the near future.

At Lakeville, Ind., a very different plan has been adopted to produce a marketable form of peat fuel. Here a complete mechanical plant for dewatering and drying the wet peat and pressing it into briquets has been erected and is about ready to begin operations, if not already at work. The plant embodies some entirely novel machinery and it is expected when it has once started that it will be in continuous operation summer and winter. This is the most complicated peat fuel plant built in this country for several years; because of the entirely new principles. as far as their application to peat is concerned, incorporated in the dewatering machinery, and in other parts of the plant, no basis for satisfactory predictions as to the outcome of the enterprise can be arrived at; the plan certainly is ingenious.

A word should be given the much-talked of Ekenberg wet carbonizing process for treating peat. By heating peat, wet as it came from the bog, under a pressure of 10 atmospheres to temperatures above 150 degrees Centigrade, it was found to blacken, lose slightly in weight, and, it was claimed by the inventor of the process, after the treatment, the water could readily be pressed from it to any required degree, giving a dense, hard, black product, which, when briquetted, compared very favorably with anthracite coal. Unfortunately, just before the last stages of the commercial plant, which was to demonstrate the value of this process, were fully worked out, the inventor died, and while it is understood that the company controlling the patents and the demonstration plant is still going forward to complete the latter, no direct report of progress has been received, since the death of Dr. Ekenberg, more than a

year ago. The process has decided merit and if it can be made commercial and the inventor's claims fulfilled, as I have recently been informed they would be, there is no doubt that another advance in peat fuel production will be recorded. At present, however, the advance is merely potential.

There are now several gas-producer manufacturers in the United States who are ready to erect gas producers in which peat can be used for fuel, but, until the fundamental proposition of securing a steady and adequate supply of peat, properly prepared, and dry enough to be used economically and with satisfaction in the gas-producer, can be met, intending users will, without doubt, not set up gas-producers for using peat, but will go on burning coal in the good, old-fashioned way. The most important thing now to be done in this country to establish peat fuel production is to really make some and let people see it and use it and learn for themselves what its merits are. It will be unavailing to show them small fragments and tell them that thousands of tons can be produced for less than $1.00 a ton, and yet be forced to admit that no one is making any at any price! One of the most encouraging signs of real progress in the development of a possible peat fuel industry, is the fact that the general public has become so wise that it no longer takes unlimited stock in any peat enterprise that is offered, but demands to be shown that the promoter has something that can really make good his claims for it. For this enlightened condition of affairs the American Peat Society is largely responsible, since it has constantly tried, from its organization, to spread accurate real information regarding the possibilities of our peat resources.

There were last season in the United States a few small peat plants in operation during a part of the summer. These all made machine peat; in one case the fuel made was partly used for burning brick; in another it was used as fuel for firing the boiler of a small factory; in still other cases reported the production was so small that it scarcely served to supply fuel for a single family, but these attempts were all of a sort that show that if right methods are used peat fuel can be made and sold here.

From Europe we learn that the amount of peat fuel produced is constantly increasing, and there seems no good reason why there should not be at least some production of peat in this country, especially where coal is so high as it is in most of the states where peat is abundant and of good quality.

On the whole there has been decided progress along the lines discussed in the utilization of peat, but in the United States there must be an awakening to the possibilities of the now nearly useless peat bogs before the wealth in them can be made available.

EXCAVATION OF PEAT BY VACUUM.

J. H. Van Glahn, Toledo, Ohio.

(Read at the Kalamazoo Meeting.)

Having just completed an installation for pumping peat, and put in actual operation a new and practical device for excavating peat by vacuum, I believe it to be of interest to the American Peat Society and others to know something of its working and usefulness.

About two years ago I conceived the idea that peat could be successfully removed from the bog by means of a power pump, and transferred to specially designed drainage bins whereby a portion of the water contained in the fibers of the peat could be removed without the use of artificial heat, thereby eliminating a portion of the fuel expense otherwise necessary to dry the product by artificial methods. To illustrate my achievement I wish to state that I met with many disappointments in the undertaking before satisfactory results were obtained.

I began my first work on the excavating plant by building the drainage bin and a scow necessary to float the pump and the mechanical appliances necessary to operate the peat pumping process. The bog in which I began operations was dry and under cultivation. A large hole was dug in the bog, which was soon filled with water from an adjoining ditch which drains the surface of the bog. The scow was launched and the pump and other accessories put on board and connected up for service.

The pump on the scow, when connected up, was 500 feet from the drainage bins on the opposite side of a railroad track by the side of which the drainage bins and peat plant are located.

The steam used to operate the pump is transferred through a line of steam pipe from a boiler located in the peat plant, a section of steam hose is used in connection with the steam pipe to connect to the pump to allow the boat to move about. The iron discharge pipe transferring the peat from the pump to the drainage bins is coupled up with flexible rubber nipples and steel clamps, which also allows freedom at this point for the scow to move about.

My trouble began with the first peat cutter which I installed to dislodge the peat from the bank. Instead of dislodging the peat and moving it towards the feed end of the suction pipe, it washed it away and the pump handled water instead of peat. After several unsuccessful attempts I installed a rotary cutter and shield, in conjunction with the iron suction pipe, which worked successfully. This cutter is hand-made, is of a special design, moves slowly and cuts very rapidly, dislodging and conveying the peat from the bank to the feed end of the suction pipe without loss of material.

The iron suction pipe is coupled up with a section of heavy rubber hose supported by an iron disc hinge and fitted up with pulley and compound gears to drive the rotary cutter when the pump is in action.

The disc hinge consists of a mechanical movement by which the iron pipe is made to swing up to any angle within 90 degrees, sidewise, or up or down, as the operator may desire.

When the pump is in action the operator, by means of a lever, controls the suction pipe in conjunction with the rotary cutter in front of the boat and cuts a swath through the peat bank in a semi-circle 26 feet wide across the bow of the boat the full depth of the bog.

The bog at Lakeville, Ind., at the point where the scow was launched, is 22 feet deep. The apparatus has pumped up every particle of the peat to within six inches of the bottom without taking up any of the sand below the peat deposit.

The mechanism controlling the suction pipe and rotary cutter is adjustable and can be gauged to any depth desired while in action.

The pump installed is of the 5-inch type. This size was chosen because the venture of pumping peat was new and the cost of a 5-inch pump was less than that of one of a larger capacity.

I have used and operated the pump during the month of June of this year (1911) for demonstrating purposes, and as many as 200 people have seen this peat pumping process in successful operation.

The pump takes the raw material from the bog as readily as water and delivers it to the drainage bins, which are located on a side hill at an elevation of 24 feet above the level of the pump, with perfect ease. Only enough water is required with the material to exclude the air.

In constructing the drainage bins three were built, hoppered at the bottom, 42 feet long, provided with chain drag conveyors under each hopper the full length of the bins. Each bin has a capacity of 3,920 cubic feet. Tests have proven that one out of three bins could be filled with peat in 10 hours' pumping. The peat, after remaining in a drainage bin 48 hours, was thoroughly drained of all surplus and latent water. The actual weight after 48 hours' deposit in a drainage bin was 78 pounds per cubic foot of raw material or 305,710 pounds, equivalent to 152 tons. By actual test made at various times I have found that 5½ tons of raw peat taken from a drainage bin after 48 hours' drainage made one ton of dry material with moisture down to 12 per cent. On the other hand, I have also made the test with peat taken from the bog before going through the pump, and found it re-

quired between 7 and 8 tons of raw peat to make one ton of dry material with moisture down to about 12 per cent.

I cannot give any definite reason why the product, after going through the pump, and being deposited in the drainage bins, produced more dry material to the ton than the product taken directly from the bog, except that the fibers of the peat are thoroughly broken by the action of the pump, and the product thereby becomes more dense. My experience has also been that if the peat is left in a drainage bin for one week it becomes almost too dry to work satisfactorily. This proves that if plenty of drainage bins are employed and suitable time allowed for drainage, a very great proportion of moisture can be extracted without artificial heat, which must eliminate the burden of drying peat to a very great extent.

We all know that peat consists principally of fine fibers which are filled with water. The action of the pump disintegrates and destroys these fibers and the water is released.

The whole pumping outfit is operated by three men. More men would be of no advantage. The machinery does the rest. It will be seen that a 5-inch pump handles wet product enough in one day to make 27 tons of dry material. A 10-inch pump will handle four times as much in the same length of time. It will require no more help to operate a 10-inch pump than one of smaller capacity.

The question is frequently asked, how about stumps, logs and roots. If a bog is full of stumps, trees and logs, these will have to be removed, the same as is necessary with any other excavating device. The suction pipe of a pump can be more readily manipulated around a stump and log than some other machines. Roots are cut to pieces by the rotary cutter and go up with the material without clogging. I arranged a screen of suitable mesh on the head of the bins where the product was pumped in. This screen allowed the peat to flow through into the bin free from all sticks, rubbish and foreign matter.

I have given the pumping process a thorough test in every particular and have operated the process on a limited amount of water by returning it to the pump after being used and expelled from the drainage bins.

In a wet bog the pumping process eliminates the necessary ditching used by other methods, and in a dry bog it is only necessary to get a supply of water to start with. The excavation soon gets large enough, and the hole will drain enough water into it to furnish a supply.

The peat pumping process has many new and valuable features, together with new mechanical appliances which make it a success practically and economically. Time and space will not allow going into details with regard to the draining bins; these are of simple construction, but of a special design.

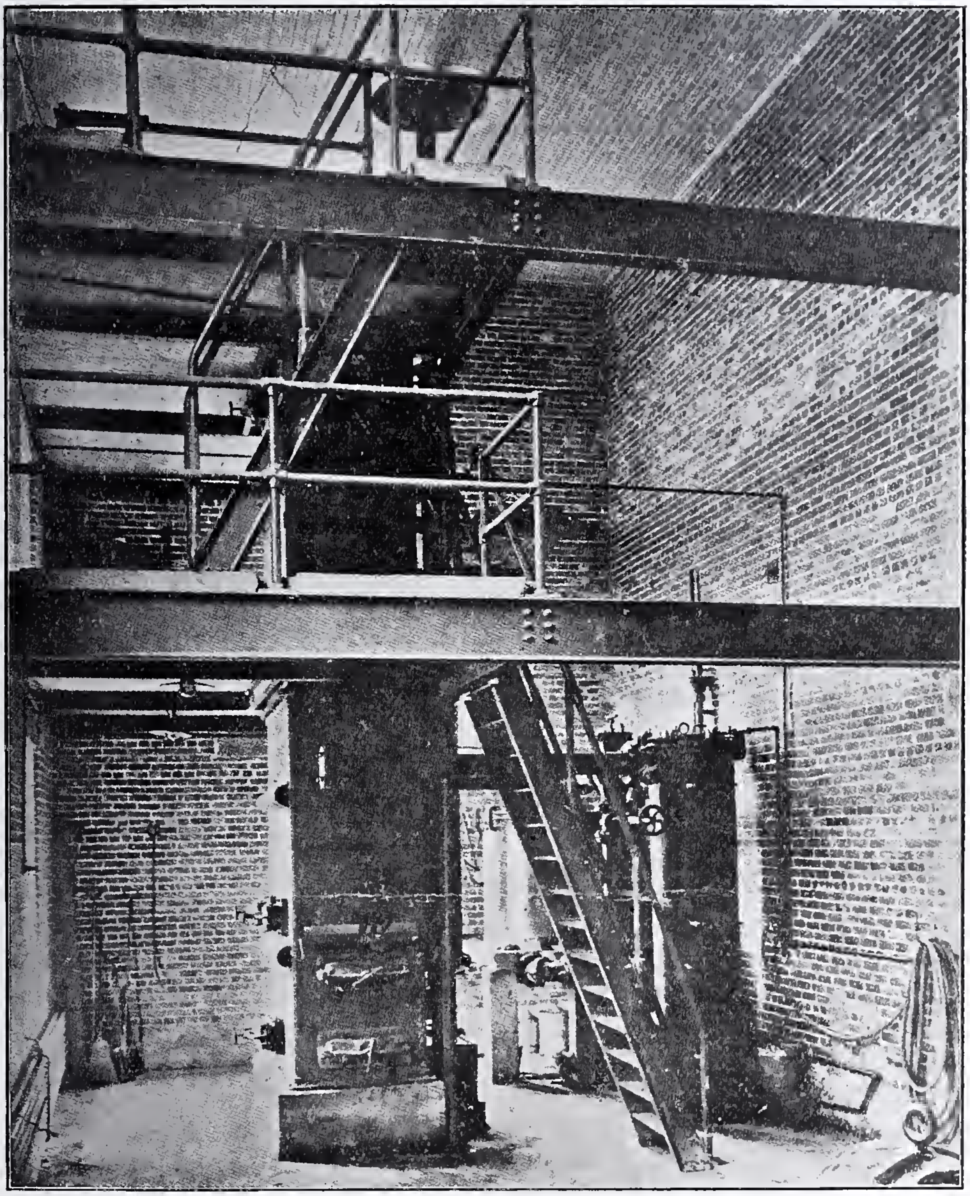

Plate II.—Sixty Horse Power Körting Peat Gas Producer at Government Fuel Testing Station, Ottawa, Canada.

THE PEAT PRODUCER-GAS POWER PLANT AT THE GOVERNMENT FUEL-TESTING STATION. OTTAWA, CANADA.

By B. F. Haanel, B. Sc., Chief Engineer.

(Read at the Kalamazoo Meeting.)

Since the presentation of this paper at the meeting of the American Peat Society in September, the interior construction of the peat gas-producer has been radically altered by the Körting Brothers, of Hanover, Germany. This alteration and certain modifications to the gas cleaning system were made with a view to reducing the quantity of tar carried by the final gas, by causing it to burn in the producer or to be split up into permanent combustible gases.

Many trials have been carried out with the producer as at present constructed and the results have shown that the plant has been much improved. The description of the alterations made to the producer-gas plant and the results of the trials carried out since the alternations were made, cannot be dealt with in this paper, since the full Government report of these trials has not yet been published.

In this paper the results obtained with the Körting peat producer-gas power plant as originally constructed and erected will be discussed and the producer itself described as far as is possible without the aid of sectional drawings which cannot at present be published.

Description of Producer.

The Körting peat gas-producer, as originally installed, consists of a rectangular steel shell about 15 feet in height from the floor level by about 5x3 feet in horizontal section. Near the top, grates are provided on either side. These two entirely independent grates are separated by a space approximately 12x12 inches. Below the grates are chambers into which the ashes drop, and these ash chambers and the grates above are accessible through two doors. About 3 feet above the floor level there is a section grate with two ash pits, one on either side, access to which is provided by two doors as above. Directly above the grates near the top or upper zone, a cast iron chamebr is provided. The chamebr is connected by means of a water-jacketed pipe to a similar chamber beneath the grates near the bottom of the producer. This is called the lower zone. These two chambers are provided with doors for the purpose of cleaning. In addition to the doors just described, there are two doors situated on the back of the producer just over the

lower zone grate bars, through which the fire can be poked or cleaned.

On top of the producer are two hoppers for feeding fuel to the two grates of the upper zone. The doors covering the ash pits of the upper and lower zones are provided with adjustable air openings. The lower end of the water-jacketed pipe, mentioned above, is submerged in a water seal.

The lining of the producer, which is made of the best quality of fire brick, conforms to the general shape of the producer for a distance of about four feet above the grate bars of the lower zone. From this point, the lining is jogged or stepped on the two narrow sides until the grate bars of the upper zone are reached, at which point the area through the linings is about 12x12 inches.

Principle of Operation.

The green peat, containing about 30 per cent. moisture and a large amount of volatile matter, is fed through the two hoppers described above, and is partially burned on the grates of the upper zone. The heat resulting from the combustion of peat is, or should be, just sufficient to drive off the moisture and volatile matter, leaving behind practically pure peat coke, which falls through the narrow openings below the upper grates into the lower zone, where the final and complete combustion takes place.

In addition to the moisture and heavy hydrocarbon vapors driven off from the peat during the process of coking, the gases passing into the lower zone contain nitrogen, a small amount of carbon monoxide, carbon dioxide, and a trace of methane and ethylene.

When the producer is in condition for operation, the space between the grates of the lower and upper zones is filled with peat coke, the lower layer of which, for a height of about eighteen inches above the lower grates, is incandescent, owing to the combustion of the coke on these grates.

The gases, heavy hydrocarbon vapors and moisture evolved from the combustion of peat in the upper zone, are drawn up (by means of the suction of the fan or engine), into the gas chamber above the grates of the upper zone, previously described, into and down through the water-cooled pipe into the chamber beneath the grates of the lower zone and then up through the bed of incandescent peat coke to the two offtakes on either side of the producer, to the cleaning system and engine.

A small quantity of the heavy hydrocarbon vapors and possibly some of the moisture is condensed on the walls of

the water-cooled pipe and drops into the water seal below, where the resulting tar can readily be removed.

The gases of the upper zone and the remainder of the hydrocarbon vapors and moisture now pass through the incandescent coke of the lower zone. Here the hydrocarbon vapors admitted into the lower zone, together with the moisture (steam), and air admitted through the air openings in the ash pit doors, in passing through the hot carbon either burn, or are split up into permanent combustible gases. The moisture is reacted upon by the hot carbon. The result of this reaction is free hydrogen and either carbon monoxide or carbon dioxide. The carbon dioxide, evolved in the upper zone, is reduced to carbon monoxide. The final gas consists of a large quantity (by volume) of nitrogen, carbon monoxide, and smaller quantities of carbon dioxide, hydrogen, methane and ethylene.

The Cleaning System.

As previously mentioned, the cleaning system consists of a wet coke scrubber, tar filter and dry scrubber.

The wet coke scrubber consists of a cylindrical steel shell about 6 feet in height by 2½ feet in diameter, closed at the top by an air tight cover and at the bottom by a water seal. This shell is filled for a height of about 3 feet with coke. When in operation, this coke is continuously sprayed with cold water. The final gas leaving the producer enters the scrubber near the bottom and leaves near the top. In passing up through the wet coke and water spray, the gas is cooled and most of the dust and a large quantity of tarry matter, which escaped decomposition in the producer, is removed.

From the wet coke scrubber, the gas passes through the tar filter. This filter consists of an iron box about 3 feet in height, and 3 feet by 6 inches in horizontal section. Inside this box are fixed a number of baffle plates and four perforated metal plates which are placed near the outlet. These plates can be sprayed with hot water when the suction on the system indicates that the filter is clogged. The gas enters at one end of the filter and passes in and among the baffle plates and through the perforated metal plates and then into the dry scrubber. Most of the tarry matter carried with the gas past the coke scrubber is removed in this filter and flows off with the wash water into the seal. The dry scrubber is a cylindrical steel shell about 4 feet in diameter by about 3 feet in height, closed on the top and bottom. The top cover can be removed. This shell is packed with excelsior, through which the gas must pass before entering the engine. Free moisture and some tarry matter is removed from the gas in its passage through the scrubber.

Results of Tests.

Several tests have been made with the peat manufactured at the Victoria Road peat bog, and with that manufactured at the Government peat plant at Alfred.

In these tests, peat with varying quantities of moisture was used, the lowest quantity being 15 per cent. and the highest about 43 per cent. Since the producer is designed to operate with peat containing from 25 to 30 per cent. water and is therefore not provided with an evaporator for supplying steam (which is absolutely necessary when running on dry fuels), 15 per cent. moisture peat was found to be too low for satisfactory operation owing to the high temperature prevailing in the producer and of the final gas—thus lowering the thermal efficiency—and the formation of some tar.

While peat containing moisture up to about 40 per cent. can be used by operating the plant at half load, the most satisfactory moisture content was found to be about 25 to 30 per cent.

Any tar which may be formed and find its way past the cleaning system into the admission valve and cylinder of the engine can be easily removed while the engine is running, by injecting into the open end of the cylinder a mixture of oil-soap and water. Tar resulting from the distillation of peat is readily soluble in such mixture and in this respect differs from coal tar.

Fuel Consumption.

The average fuel consumption per B. H. P. H. at full load (60 H. P.), was found from many tests to be from 2¼ to 2½ pounds.

For one brake horse power year of 3,000 hours (300 ten-hour days), this would amount to 3.75 tons.

For the purpose of showing the saving in fuel costs which can be realized by generating power from peat in the peat producer-gas plant, the following comparisons are given:

In estimating the following costs, the cost of one ton (2,000 lbs.) of machined peat, at the bog where the producer-gas plant is assumed to be situated, is taken at $2.00. The cost of a ton of soft coal is assumed to be $4.00 in carload lots, f. o. b. At some points this price would be less, while at others it would be considerably higher.

The consumption of peat per brake horse power hour is assumed to be 2½ lbs.; lower fuel consumptions have been obtained, but the writer desires to use a conservative figure.

The fuel consumption per brake horse power hour of the coal producer-gas plant is taken at 1½ lbs., and that of the

steam plant at 6 lbs. The latter figure relates only to comparatively small plants.

On this basis, the fuel costs per brake horse power year (3,000 hours), would be as follows:

	Fuel cost per brake horse power, Year.
Peat producer-gas plant, peat at $2.00 per ton	$ 7.50
Coal producer-gas plant, coal at $4.00 per ton	9.00
Steam plant, coal at $4.00 per ton	36.00

When peat is manufactured on a larger scale, with machines provided with mechanical excavators and other labor-saving devices, the above cost ($2.00), per ton will be very greatly. reduced, so that a power plant situated at the bog will be able to show a much greater saving in fuel costs over that of a coal producer-gas plant or steam plant.

In order to arrive at the saving which will be effected by the utilization of either peat or coal in a producer-gas power plant over that of steam power plant, it is not necessary to estimate the operating costs and fixed charges, since these will remain about the same for all the plants in question. A slight saving will, however, be realized in the peat producer-gas plant, over the steam and even the bituminous coal producer-gas plant, in the operating costs, since the peat producer-gas plant is very easily handled, the produucer practically taking care of itself. Hence one man, an engineer at moderate wages, can easily take care of a 100 H. P. plant. While this is true in a general sense, the writer has seen a 150 H. P. bituminous coal producer plant handled entirely by one man, but such cases are not common. A bituminous coal producer is more difficult to operate and requires more or less constant attention, and therefore for proper working should have the services of a stoker. A steam plant of like capacity would require a fireman in addition to the engineer. In short, a peat producer-gas power plant, in its simplicity and ease of operation, is not unlike an anthracite producer-gas plant, which is recognized as the simplest of all such plants.

While hydro-electric energy is in many sections of those provinces possessing water powers, the cheapest power available, and for many purposes the most suitable, it must be borne in mind that there is a limit to which electric energy can be economically transmitted, since the cost of power increases rapidly with the length of the transmission line. In addition, there are localities which cannot be served by such transmission lines, and still others to which such power is not suitable —for example, those requiring a ten-hour or intermittent serv-

ice. For such districts, it is manifestly cheaper and more satisfactory to develop power independently by some other means, and it is hoped that producer-gas power plants erected on a few wisely chosen bogs will serve this purpose.

The demonstration plant at Alfred and the peat producer-gas power plant erected in the Fuel Testing Station at Ottawa (the former serving to demonstrate a commercial process for the manufacture of a cheap fuel from peat and the latter serving to demonstrate an entirely commercial, economical and reliable method of generating power from such fuel), will, it is hoped, prove instrumental in:

1. The development of such of the peat bogs found in the provinces of Ontario and Quebec as are suitable for the manufacture of peat fuel, along sane and commercially profitable lines.

2. The establishment of power plants on the bogs, which will serve existing towns and cities with electric light and power, and attract industries to those parts of the above provinces which can be economically and satisfactorily served by such power.

Dredging Peat. A floating dredge with a clam-shell, orange-peel, or other type of dipper, makes an excellent excavator for peat fuel operations on our undrained American bogs, if proper facilities can be provided for taking away the peat as fast as it can be dug, without too great cost. It is reported that such a dredge, with a dipper of the proper type and size, can be made to dig, handle and load one and a half cubic yards of wet peat a minute, with a force of two men. The dredge scow can be moved easily from place to place, and can be made fast with equal ease. A suitable dredge can be built and equipped in most parts of the country for less than $5,000. A dipper of the size mentioned can easily handle stumps and logs and lay them out on the surface at one side of the openings. The costs of operation, including wages, fuel, oil, etc., need not exceed $10 a day, and the production of wet peat can be made to equal the full capacity of the dredge, as little time need be lost in moving, loading, etc.

The peat, as fast as it is dug, can be dropped into tram cars, of the usual dumping pattern, brought to the dredge on suitably designed scows. The scows should have tracks laid on their decks, so that the cars can be quickly run off and on them at a landinig place which would also be the conveying point of the track system connecting the macerating plant and the drying grounds. The cars could be drawn by gasolene or electric locomotives.

C. A. D.

OBSERVATIONS AND DEDUCTIONS FROM TRAVEL AND CORRESPONDENCE.

Francis J. Bulask, Toledo, Ohio.

(Read at the Kalamazoo Meeting.)

The last year has probably been the most peculiar in the history of the peat industry heretofore, that is, generally speaking. Wherever a peat man was met, the air was surcharged with: "We have accomplished it. Our process is the only successful one. Our machinery has solved the problem. We are the only simon-pure, bred-in-the-bone peat men in the country. Look at us, feast your eyes upon the real thing." After you had satisfied his vanity, you took courage to ask a few questions, wanting to know more of the wonderful results obtained. You were invariably given a look as much as to say, "Don't you believe me?"

Right away you felt like apologizing, but your keen desire to know more of the facts gave you courage to ask to be shown. Here, usually, there came a hem and haw, and after a questioning glance from you, intimating that you were not to be put off, an explanation that the machinery was temporarily out of commission, having improvements made on it; or that the inventor who had the plans was out of the city, or more often, as the patents had not been granted as yet, the principle of the machine, or the process, could not be demonstrated just then, but nevertheless, be assured of the fact that we have it, and if you are wise, you will invest a few thousand dollars in the stock of the company, **now**, as it will surely go to par in a week. The company is conservatively capitalized, only $50,000,000, all common; the profits will be enormous, and so on and on. This illustration has a number of versions, but with the difference that one may be a promoter's scheme worked for commissions on stock sales, and the other from purely honest, but perhaps misguided reasons. Each, in his way, has done a lot of good for the industry at large.

The writer in his travels has had considerable opportunity to observe that one of the greatest mistakes made, has been a duplication of efforts. Just because a few miles of states separated the individuals, they sufficed for each to work along similar lines, entirely unknown to the other, and this in the light; of the publicity usually solicited and received, has been one of the peculiarities observed.

Another mistake has been made by mechanics who have learned there was such a thing as peat and that producingg fuel

from it had a few attendant difficulties. They, without any reference to the endeavors of others, would solve all the problems off-hand and obtain the financial support of friends. Later, when no funds were left these men would acknowledge that they did not know it all, but become more positive than ever that they had the final solution within grasp, could they but get money enough to change this or that, or install such or such devices. And, even after dearly bought experience with this kind, a man is sometimes easly misled by some new-fangled moisture extracter or press, most often originally built for entirely different purposes. No doubt a number of instances occur to those familiar with our history of peat, so there is no need to recall them here.

The most peculiar mania, and I believe that is the right word, is exhibited by those whose knowledge or familiarity with peat dates back but a short time, is the insistence—after conclusive proof has been furnished them—with which these people stick to their ideas. A recent instance of this kind took place in Ohio. A drier was contracted for, to cost several thousand dollars. I was surprised to learn that no accurate estimate of its capacity per hour, how many pounds of fuel would be required to evaporate so many pounds of moisture, together with a number more important details, was known; all this, in ignorance or wholesome good faith, was left to the drier manufacturer, who probably knew little of the difficulties of peat drying. Nothing I could say could change their minds, and I learned later, that they were still of the same mind and were going to install this drier. Such faith in the expositions of others surely merits success. In other arts it sometimes does, but not in peat as far as my knowledge goes. This faith seems to be an inherent quality in the peat novice.

No greater good to the peat worker of this country ever happened than the organization of this and its sister society, with their aims and purposes of assistance and dissemination of reliable information, and you would hardly believe it, but it is a fact nevertheless, that a man—who in 1904 and 1905 spent thousands of dollars of his own on a briquetting proposition—told the writer no less than two months ago, "that he had been in the peat business and knew all about it." The peat societies could tell him nothing. Further discussion elicited the information that he had not followed any developments within the last few years, believing the venture he had put his money into was the last word in peat endeavor. He is here today, convinced that these societies are an agent for all that is good in peat, and I feel positive he will become an active member.

A peculiar trend of the beginner that has forced itself

upon my notice, is the tendency to work along artificial lines: that is, manufacturing peat fuel by means of steam or other drying methods, and briquetting. I have been told of a company that has spent $45,000 on this method, without the develepement of a new idea. I saw the machinery while under construction; it appeared to be but a repetition of a number of plans tried out before. Had those behind the enterprise investigated the present-day status of this industry, had they joined one or the other of these societies and availed themselves of their information, most of this could have been saved. I do not want to be understood to say that no artificial method can or will be developed, as I feel satisfied that an acquaintance of most of us here today is going to do so, owing to several circumstances, one of which is the inclination and ability to dig into his own pocket; and another, the getting together of an outfit which daily gives more promise of success, and, according to his statements, which I am confident are reliable, he expects to manufacture a ton of briquets for less than $1.00, all costs considered. As to the shipping and burning qualities of his fuel under varied conditions, he has had but little opportunity to satisfy himself, but I predict, should he persevere, and I believe he will, we will be pleased to learn he has accomplished his object by this time next year.

The general drift, however, is towards the wet process on a large scale. Now and then we hear of some one, or company, talking of importing foreign machinery. This I personally believe to be a mistake, unless it is taken in hand and adapted to American peats and labor conditions, which really means as much or more work than building machinery designed according to our requirements, unless the importer is an expert capable of using the best in the foreign devices, some of which we must acknowledge to be almost fundamental in their application and will come into general use. What these are I may take up in another paper, fearing at this time of being accused of having an axe to grind.

One wet process installation that merits more than passing notice was witnessed by me while in operation, a month or so ago. The results achieved were in the light of an agreeable revelation, inasmuch as it all seemed to work so simply. I could see where a number of improvements could be made—and so no doubt could any one who had followed peat development for a number of years—this, of course, after the plant became operative. I am satisfied, however, that the next plant this company builds—which I was told would be this winter—will overcome these defects, which could only be detected under operating conditions. To my mind the principle ap-

peared correct; the excavation was automatic, the maceration good, the conveying and distribution left some things to be desired, but when it is taken into consideration that so much has been accomplished, it is easy to believe that the remaining difficulties will gradually be surmounted. In fact, I feel safe in saying that the production of peat fuel on a large scale in America has practically been solved. It is known that this style of fuel, properly macerated and dried, is more or less impervious to moisture; it is known that it will stand shipping in open cars, and as this country houses many foreigners familiar with peat, and as there are large sections of this country that will welcome the coming of most any kind of good and cheap fuel, a ready sale at a good price should await its being put on the market in large quantities.

Another observation extending over a wide area of country is the late developed but no less agreeable conservatism shown by present day investigators, men who are really doing something, doing it with understanding, and therefore with the usual accompanying results. During no year of my peat experience has the feeling of something being done been more prominent than the one just past; braggadocio has been put aside, the easy-going public, sensitive to well written advertisements, who formerly opened their pockets and bought stock, have become skeptical of the word peat. The vocation of the peat stock promoter for a time has passed, and only those who have been earnest in their endeavors and knew that peat, like other refractory substances, would finally yield its secrets, if sufficient intelligence and perseverance was shown, have stuck to their work and had nothing to say, knowing full well that the fruits of their perseverance would speak loudly for them.

Taking it all in all, the passing of the stock jobber, the taking cognizance of what others have done or are doing, the loss of the know-it-all-and-it-must-come-right spirit, the benefits to be obtained through membership in these societies, the honest work and results brought forth this last year by the workers on both the wet and dry processes, bespeak much promise for the immediate future. But by far the most encouraging sign is the interest being shown by successful business men and corporations. The inquiries received for information on peat gas-producers from leading companies of the country, foretell an awakening to the possibilities latent in peat, not equaled by any other sign of the times, which all proves to me that we are in a transition period, from the experimental to the successfully accomplished, and I stand here to say that my observations and deductions of the past year lead me to the conclusion, that instead, as heretofore, of nine-tenths

of the money invested becoming a total loss, nine-tenths hereafter will bring forth fruitful and satisfactory results.

I look forward to the establishment of several large and small peat fuel plants this coming season, all of which should, and some of them will, operate at a profit. This will confirm a few of the broad statements made years ago and attract, more and more, the eye of capital that has been patiently awaiting the time when only a small fraction of the many glowing statements made for peat have become facts to take hold, and when, as in the last ten years prior to this year, little progress has been made, the next few will establish this industry on as firm a footing as any other, and we who are here today may look back with satisfaction in the belief and trust we had in its ultimately working out as we have wished.

A New Process for Utilizing Peat. According to The Engineer of May 10, 1912, Mr. F. H. Nixon has invented a new process for converting peat into usable fuel. The invention consists of cutting the peat, after it has been air-dried, into corrugated blocks, which are sprayed with petroleum. The blocks are subsequently given a coating of highly inflammable material, which also strengthens them and prevents them from breaking easily. It is claimed that this process overcomes the obstacles hitherto associated with the combination of peat and petroleum, which have been connected mainly with the employment of a briquetting machine that is not only difficult to work, but also expresses too much of the petroleum from the finished block. It is proposed to use the method, which can be worked at a very low cost, for the production of fuel on a large scale.

Irrigation with Lake Muck. C. R. Sandvig, of Belgrade, Minn., reports in Irrigation Age that he pumps the soft mud from a lake bottom with a centrifugal pump run by gasoline motor, or later, by a small steam traction engine fired by straw. The pump forces 260 gallons of muddy water a minute through 600 feet of pipe and several hundred feet of graded up ditches to the highest part of the land, and from there the water and mud run in furrows plowed between the planted rows. In this way he irrigates as fast as one man could cultivate with one horse, while the muck left behind by the water is considered equivalent to the manure that could be hauled by two men with teams. Only three men are needed to run the outfit, one to run the engine, one to irrigate, and one to operate the dredge to see that it pumps mud. This system has been used since 1907, but it was especially successful in 1910, when there was a severe drought in Minnesota.

RECENT DEVELOPMENTS IN PEAT MACHINERY.

Ernest V. Moore, Peterboro, Canada.

(Read at the Kalamazoo Meeting.)

In attempting to outline my subject, the conviction was forced on me that I had nothing to offer that seemed to me to be "real meat." I have no desire to impose on you with a re-hash of what has already been written, and as I am not knowingly a humorist, it might prove tragic should I attempt to amuse. I can therefore only mention the Dominion Government effort, Peat Industries, Ltd., Dr. McWilliams' work, and try to give you a few facts and my impressions, and to outline my own work and what I hope to accomplish.

And firstly, in regard to the Canadian Government work at Alfred. This season has, on the whole, proven quite satisfactory. Complete figures are not available, as it is contrary to precedent to make public such figures before their official publication. I have been at the plant recently, however, and believe a conservative statement of the output would place it between 2,300 and 2,400 tons. Work was done for 85 days and I estimate the total outlay for the season to be not far from $3,000.00. This shows a very encouraging cost per ton on the field, and completes another step in the work undertaken by our president, Dr. Haanel.

The weather conditions this season have been very good, but the showing has been handicapped by the following circumstances: Mr. Bengtsson, who was in charge, had to work with a crew of men who could understand English only slightly and Swedish not at all. Mr. Bengtsson, on the other hand, speaks no French and at first had almost equal difficulty with his English, so that detailed instructions, of necessity, took much time to reach their mark.

Secondly, the men were working for the Government, and as government employees, more or less under a patronage system of holding their jobs, could not be handled as efficiently as by a private corporation, and thirdly, the output per day was considerably lowered by delays caused by lack of certain repairs, not made because the Government had only in mind the following things:

First—To demonstrate a plant successfully operated in Europe.

Second—To show a good fuel could be produced.

Third—That the fuel was adaptable to transportation over long distances.

Fourth—That there was a market for such fuel, and

Fifth—When these were done, the work with the manufacturing side of the operation was complete.

That the Department of Mines has accomplished what it set out to do, there is no question. The authorities have never claimed, as has been imputed to them, that the plant at Alfred is the best or most modern; in fact, Dr. Haanel distinctly recommends more advanced and modern machinery, specifying more particularly the adoption of excavation by power and operating on a much larger scale, but the principle of the operation being demonstrated, the Government proposed to let private effort do the rest.

Peat Industries Limited, of which Mr. Lincoln is Vice President and Manager, have made the first experiment along this line with their 2,000 tons of raw material per day of 24 hours, excavator. Of the success of this machine I cannot speak definitely, as I have only seen the photographs, but I understand the output for this season has been only 600 tons of fuel. No doubt, however, even this small amount will be productive of much valuable experience, and the small amount of fuel made may be explained by the late delivery of machinery and the villainous delays in getting a totally new mechanism in operation.

From the photograph, I would judge this excavator resembles to some extent that of Lieut. Ekelund, except for the changes necessary in setting it on top of a bog instead of on the bottom, and using gasoline power for driving.

With Mr. Haanel, I visited Dr. McWilliam's plant a month ago, and I wish to pay tribute to Dr. McWilliam's stick-at-it-iveness and to his perseverance in overcoming obstacles, and to venture the opinion, that, my own arguments to the contrary notwithstanding, if the Doctor is not beaten out by lack of means just on the eve of success, he will make an economic briquetted product from peat, in a satisfactory commercial way.

The collecting of his peat powder from the bog, containing from 40 per cent. to 25 per cent. water, is an accomplished fact in a commercial way. His drying this to practically bone dryness, has also been accomplished in experiment in commercial quantities, and I believe it is only a matter of installing a properly built drier to replace his experimental one, to put this operation also beyond question. His briquetting has also been tried out in a very fair way, so that it would seem, that there will probably be an exception to prove our rule about the uselessness of trying to make peat briquettes by pressure.

Since the last meeting of this society, my own work has dealt with an effort along the same line as Peat Industries Ltd.,

but I will have to wait until another season to announce my success or failure.

During this year, I have corresponded with Mr. A. Anrep, Sr., whose home is in Helsingborg, Sweden. We have taken up the most desirable methods and devices to remedy the shortcomings and inefficiencies shown at the plant at Alfred. After a business arrangement had been entered into, whereby I became his agent in Canada and the United States, and undertook to have a complete plant built and put in operation on this side of the Atlantic, he prepared for me drawings and specifications of a new plant of comparatively large capacity, incorporating therein all his ideas. These detailed drawings are now in the hands of the pattern makers and builders, but I have a few general drawings with me, which I will be pleased to show and explain to any one interested.

Before attempting to describe the improvements that have been made, I wish to confirm the announcement in the last Journal. I expect to have this plant complete, and installed on a convenient bog in Ontario, in time to begin operating next Spring. During 1912, it will be open for critical inspection to all parties interested and at all times, beginning as early as the weather will permit. The location of the bog will be announced when it has been definitely decided upon.

The process of manufacturing machine peat fuel, illustrated at Alfred, may be divided into excavating, macerating, spreading and moulding, and harvesting, and it is difficult to conceive a machine peat process that will eliminate any of these operations. At present, at Alfred, seven men are used to do the excavating, and upon their efficiency and inclination to work depends the output of the plant. For a larger capacity, say, of 7½ tons of fuel per hour, about 16 laborers would be required. The first change introduced in the new plant is substituting a power operated excavator, looked after by two individuals, one of whom is occupied taking the roots out of the way of the excavator for the hand excavating just mentioned.

This device is of the continuous bucket and chain type, and is exceedingly simple and strong. The chain and bucket are carried in a light structural steel frame, mounted on wheels, which move obliquely across the line of the ditch that is being excavated, on a pair of rails, supported in turn by a platform on which is a macerator and a motor to drive it. Here also is the driving mechanism for the peat cars and the spreading device, as at Alfred.

The unique features of this device, outside of its simplicity, are:

First—Owing to the method of its mounting it leaves all standing walls on a natural slope.

Second—It cuts a uniform section, taking out the raw material completely and cleanly and systematically and economically exhausts the deposit.

Third—The spread of the rails supporting the framework carrying the excavator proper, is so great as to reduce the pressure per square inch on the bog, due to the weight of the machine, to a small fraction of a pound per square inch.

Fourth—Individual motor drives do away with heavy gears and other transmission, making the device light, and on account of electricity being used throughout, the controls are arranged very conveniently.

The proposed excavator will dig about 28 feet wide and down to 12 feet deep, and will make 10 lineal feet of trench per hour.

The puddling will be done by an advanced type of Anrep macerator of much increased size and capacity. A number of new conveniences are adopted, and new designs incorporated, which will permit of regulating the amount, or extent, of the pugging.

In operation, the excavator proper moves from side to side, the whole device moving ahead about 8 inches as each backward and forward cut is made. It delivers the peat into a trough, running the length of its travel, which in turn deposits it in the hopper of the peat mill. The macerated peat pulp will come from this device as a whole, on a projecting conveyor in a similar way to that at Alfred, at present.

The spreading field will be up to 850 feet wide, as compared with 450 feet at Alfred, and new design has been incorporated that will permit of moving the spreading track in 10 minutes, as compared with 25 minutes now. The spreading device will work in both directions, instead of only one way, and 12 moves will be made per day of 10 hours.

The spreading device is also improved to give a more uniform product, to automatically cross cut, and to do away with the attendants now used to level the peat mass in the spreader hopper.

These changes, improvements, I hope, will give us a plant operating with no greater overhead charges than of the government plant, having practically three times the capacity shown there, and using in all, only 10, or at the outside 12, operators.

The theoretical capacity of this plant is almost 300 tons in 24 hours, but for estimate, an output of only 7½ tons per hour, or 150 tons per day, is calculated upon. On this basis, it is ex-

pected to cut the present cost of manufacture at Alfred in two, and at the same time produce a more uniform fuel.

The harvesting will be continued in the same manner as at present, i. e., turning, curbing, and storing, more or less by hand.

This plant is being erected by private capital and will be manufactured on this side of the Atlantic, and should the plant live up to my expectations, it is proposed to offer it to the public as reasonably as possible.

I was about to close my paper here, when I received a copy of the Mark Process Company's Prospectus. I presume each member has received one of these documents and as this seems to rationally come under the head of my paper, the following few observations may not be out of place.

The prospectus leads one to believe that the company have had a much to be desired success with their practical demonstration on packing house material, and I am inclined to feel convinced they are safe in making their very convincing offer to show greater efficiency than other driers in the market, that is, **in so far as they confine themselves to drying materials that have been already commercially dried by other artificial driers.** I feel, however, my present effort will not be in vain, if I am able to do no more than point out a few facts that may lead to a more careful consideration of the situation before any attempt is made to dry peat containing **85 per cent. water.**

Before going into this question I feel that the gentlemen responsible for this prospectus will thank me to point out an error in their statements with regard to peat. On page 10 appears the statement that at the Canadian Government Experimental Station, peat could not be put into marketable condition under $3.25 per ton. The Government report for 1910 will show this was done for $2.29, under abnormally unfavorable conditions, and from my own inspection of their work, I feel convinced that this season's operation will show that Dr. Haanel's estimate of $1.50 per ton is quite conservative.

Following the statement mentioned in the last paragraph, the prospectus further points out that by the Company's process, peat containing 85 per cent. water can be dried for 60 cents per ton. I am not exactly clear as to just what the Company means by this statement. It may be that they refer to drying one ton of wet material for 60 cents, and with this understanding I do not take issue, but from the context of the prospectus, it appears to me they wish to leave the impression that they propose to produce one ton of dry material from raw material containing 85 per cent. moisture for 60 cents. Under this understanding, I have the following to submit, and it ap-

plies to all drying operations, as well as drying peat, and to any drier using heated or natural airs alone to extract moisture, I feel my figures may prove of value.

In the Mark Company's drier, all water must be carried away in suspension in air.

To obtain one ton of dry peat from raw material containing 85 per cent. water, 13,333 pounds of water must be carried away.

There is a definitely established point of saturation of air, which varies at different temperatures, for example, at 32° F. a cubic foot of air will carry in suspension only 2.3 grains, at 100° F. 19.1 grains, at 185° F. 85 grains, and at 212° F. 265 grains.

The Company's process contemplates the temperature not over 124° F., at which temperature the air will carry off about 40 grains per cubic foot, i. e., if absolutely dry to start with, and altogether saturated as it leaves the device. The air from outside, however, on an average will be already quite 50 per cent saturated so that it will not pick up and carry off more than 20 grains per cubic foot, that is, keeping in mind the temperature of this air is at 124° F. This means that 170,000 cubic yards of air must be supplied to carry off the water to obtain 1 ton of dry fuel. This is a large quantity of air to handle in any drier, and it is questionable if a plant can be built sufficiently large and still not be too cumbersome to permit of this air moving slowly enough to get anything like saturation. In fact, it is the speaker's opinion that even with the evidently more or less perfect contact obtained in this device, it will not be possible to get anything like complete saturation.

However, leaving this argument aside, this air cannot be obtained at a higher temperature normally than 70° F., to raise it to 124° F. means a difference of 54° F. Now 170,000 cubic yards of air weigh about 340,000 pounds. The specific heat of air is .237, therefore, to heat this air will require about 4⅓ million B. t. u, so that, leaving out all consideration of labor, overhead charges, etc., and neglecting the question as to whether a plant to handle this quantity of air is even a mechanical possibility, without being too cumbersome to be practical, the Company propose to move more than 170,000 yards of air through their device, supplying it 4⅓ million B. t. u. for 60 cents.

This problem, it seems to me, requires more consideration than I believe it has been given.

NITROGEN IN PEAT HUMUS.

(Reviews by Herbert Philipp.)

The scientific investigation of the forms in which nitrogen occurs in peat has only been made the source of serious study among chemists during the last few years, although it has long been considered an important subject.

We have now before us two important works of recent publication which are of distinct interest to agricultural "peaters"; the works referred to are: "Organic Nitrogenous Compounds in Peat Soils II." by C. S. Robinson (Mich. Agri. Coll. Expt. Sta., Bul. No. 7, 1911), and "The Chemical Nature of Organic Nitrogen in the Soil," by Dr. S. L. Jodidi (Iowa Agri. Expt. Sta. Bul. No. 1, 1911.) The latter author is well known among our members, having done valuable work in the studies of peat in Michigan and contributed a paper on this subject to this Journal (see Vol. 2).

For years chemists have been endeavoring to extract definite chemical compounds from peat, yet the most notable feature about the investigation has been the different results obtained by different authors and it is only very recently that such researches have been of the kind that have stood the tests of later investigations. During the last few years, however, the study of nitrogenous compounds of peat and humus have been carried on in a more scientific manner, with the result that more progress has been attained than by all the preceeding work done.

The agricultural value of peat, either as a fertilizer or as a soil type for cultivation, has led to several opposing opinions between practical agriculturists in this line and some of the agricultural experiment stations, yet it is possibly agreed that all the nitrogen present in peat is not readily available for plant food. It is therefore very gratifying to have chemists study the various combinations in which nitrogen occurs in peat and thus make it possible for the scientist to devise some method for making peat nitrogen more readily available as a fertilizer. It is in this light that these last studies of peat have been carried out; the subject is an exceedingly complex one, but by time, together with patience and perseverance, we may hope to arrive at a solution to these interesting and important questions.

C. S. Robinson's work offers the following conclusions: Evidently the decomposition products of plants contain comconsiderable portion of the nitrogen is present in the form of a

considerable portion of the nitrogen is present in the form of a protein compound, or a mixture of such compounds, which can be broken down on treatment with acids in the same manner as casein, egg albumen, etc. In the samples of peat studied in this work about 26 per cent. of the total nitrogen was combined in this form in such a way that it could be converted by hydrolysis into primary amines, probably with the formation of amino acids. About 10 per cent. of the total nitrogen is due to the presence of acid amides. The greater part is, however, present in forms concerning which we know nothing and which may represent the most important factors in aiding and inhibiting plant growth. It seems probable, from the work done so far, that the classes of compounds constituting this unknown residue are many. The greatest need at present in determining the value of the organic nitrogenous material of peat and humus is a closer knowledge of the individual substances actually present in such material and those which may possibly be formed by natural agents in the soil.

The author describes in detail the isolation of two individual amino compounds from peat, viz.: leucine and isoleucine (see this Journal, Vol. 4, p. 126).

S. L. Jodidi has treated the subject of soils generally, yet the work described is of considerable value to "peaters," as the conclusions show: There is a marked difference between the organic nitrogen formed in the soil from comparatively fresh organic materials on the one hand and organic nitrogen formed from comparatively old organic materials on the other. While in the first case, with exception of from 8 to 12 per cent., the organic nitrogen consists of acid amides, diamino acids and monamino acids, it contains in the second case a considerable percentage (from 47 to 60 per cent.) of compounds belonging to classes other than acid amides and amino acids. These figures refer to acid-soluble nitrogen.

Since it has been found that the organic nitrogenous compounds in Iowa soils as well as in Michigan peat soils are made up chiefly of acid amides and amino acids, despite a considerable variety of the sources of the organic nitrogen, it seems fairly safe to state that the bulk of the organic nitrogen in the majority of soils, if not in all, consists very likely of acid amides and amino acids.

The second and third parts of Dr. Jodidi's investigations regarding the organic nitrogen in the soil, appears in Research Bulletin No. 3 of the same station, and delves still further into the isolation of organic nitrogen compounds from the soil.

POWER FROM POWDERED PEAT.

By Dr. J. McWilliam, London, Ont.

(Read at the Kalamazoo Meeting.)

This subject has been given a new interest from the exhaustive experiments of Lieut. Ekelund in Europe, and as I had used powdered peat to produce power at my peat factory near London, Canada, for two seasons four years ago, I have been requested to give a short paper on the subject in order to bring before the Society the possibilities that are contained in this method of obtaining energy to drive machinery.

Lieut. Ekelund states that a ton of powdered peat containing about 15 per cent. moisture is quite equal in heat units to a ton of good soft coal, and, if properly applied, will go as far in raising steam as a ton of coal. Usually a ton of good soft coal is looked upon as equal to 1.8 tons of peat, that is air-dried machined peat. But Lieut. Ekelund claims that the combustion is so much more complete and the amount of air required is so much less in amount that the above result is obtained. The larger amount of air required in the combustion of a ton of coal has such a cooling effect on the boiler that much of the heat of the coal is lost, whereas the smaller amount of air required for the complete combustion of peat allows all the heat energy of the fuel to be delivered to the boiler.

Assuming that this is a fact that a ton of powdered peat is equal in heat giving properties, or nearly equal, to a ton of soft coal, then the method of obtaining powdered peat of a moisture content of 5 per cent. to 15 per cent. becomes a very important matter.

Lieut. Ekelund describes his method of digging the peat and air-drying it, of harvesting it in the form of blocks, at from 30 per cent. to 50 per cent. moisture content, according to the weather prevailing during a given season. At this point in the preparation of peat powder he describes methods of grinding, etc., which he has discarded, but does not tell us how he grinds it now, nor how he dries the powder to the point where it is an efficient fuel. As I have had some experience in grinding peat, and also in grinding peat powder, I am extremely curious to know the details of his method of grinding peat and also of applying heat to dry it. Had I those details I would have been in a much better position to calculate the cost of the whole scheme if carried out in our country. This grinding and drying of peat with 25 per cent. to 50 per cent. of water is a most difficult proceedure. I cannot understand how he can grind it into a fine powder when it is so wet. Of

course, he says he does it, and until we get a description of his pulverizing apparatus we must leave the matter there. He also says he dries it to 15 per cent. moisture; granted that it is ground fine enough, I believe this can be done, but it is difficult, and a detailed account of his drier would interest me very much.

Our own experience with collecting and drying peat powder by the Milne machine has been satisfactory, and from the first, has been commercially successful. We harrow the surface of the bog, exposing the broken peat to the influence of the sun and wind, which, in favorable weather, very quickly reduces a thin layer of peat to a moisture content of 25 per cent. to 40 per cent. Over this prepared surface we pass a suction fan collector, which sucks up the dry material and leaves the wet. The peat is placed in our storehouse by this means as a finely divided powder, nearly all of it fine enough for use as a fuel under a boiler as applied by Lieut. Ekelund. Thus, by simply harrowing the bog and then sucking up the dust, we harvest our peat and grind it at one operation, also drying it to 25 per cent. to 40 per cent. moisture. All the expense of digging, stacking, carting and grinding being thus finished in a single operation. We have no absolute details of the cost of collecting a ton of this powder in this way, although many attempts have been made to get at the actual outlay. I never was quite satisfied, however, that every item of expense was included, and until we come to run commercially it will be difficult to give an accurate statement. This much is certain, that we can put this powder in our storehouse at less than 75 cents per ton—which, in this country of high wages is much better than Lieut. Ekelund has done, and my own conviction is that we can collect this powder at less than 25 cents per ton if our bog were a large one and our automobile collector were completed.

As to our experience with firing with peat dust, our great difficulty was the grinding. We would wear off a set of plates in a day, and the dust and noise of operating the grinder were intolerable. It was a very efficient steam raiser, however; was simple to operate and did not injure the boilers. But as wood was plentiful and the drying and grinding so difficult, we gave up using it as a fuel two years ago. But if I was assured that some efficient means of grinding the peat could be had I would return to it again, as it was a cheap and efficient means of raising steam.

ENGINE GAS FROM PEAT.

(Journal of Electricity, Power and Gas.)

The production of gas from peat having a low water content (up to about 20 per cent.), for use in suction gas engines has already met with considerable success in Germany, but for a number of years efforts have been made to utilize peat with a water content as high as 50 to 60 per cent. and thus eliminate the cost process of drying the raw material.

Difficulties have been encountered in preventing a loss of heat through radiation and other causes, and in getting rid of the dust and tar vapors carried over by the gases to the engine; but great strides have been made recently in overcoming these obstacles. Peat with a water content up to 60 per cent. has been found to be a suitable fuel. Owing to its great porosity and low specific gravity, it presents a large combustion surface in the generator, so that the oxygen in the air used as a draft can easily unite with the carbon of the peat.

One of the great difficulties is to eliminate the tar vapors that clog up many of the working parts of the engine. The passing of the gas through the wet coke washers and dry sawdust cleansers does not appear to have thoroughly remedied the evil. Efforts were therefore made to remove the tar-forming particles of the gas in the generator itself, or to render them harmless. That of the Aktien-Gesellschaft Görlitzer Maschinenbau Anstalt und Eissengiesserei of Görlitz, was displayed at the exposition at Posen in 1911. The gas from the generating plant was employed in a gas-suction engine of 300 horsepower used to drive a dynamo for developing the electric energy for the exposition. The fuel used was peat with a water content of about 40 per cent. The efficiency and economy results obtained were very promising.

The advantages claimed for the Görlitz engine are that the sulphurous gases and those containing great quantities of tar products are drawn down by the suction of the engine through burning masses of peat and thus rid of their deleterious constituents. The air for combustion purposes is well heated before entering the combustion chamber, thereby producing economical results. It is claimed also that the gas produced by its system is so free from impurities that the cleaning and drying apparatus may be of the simplest kind.

The cost of the peat used (water content, 40 per cent.), was $0.57 per metric ton (2,204.6 pounds). In two trials the consumption per kilowatt-hour obtained was 3.43 pounds for the first trial and 5.31 pounds for the second.

THE PEAT INDUSTRY IN RUSSIA.

(Engineering, June 7, 1912, p. 776.)

The Department for Peat Exploitation of the Russian Ministry for Agriculture has, during 1911, continued its survey of Russian peat deposits, both in Europe and Asiatic Russia, with the result that in nine Governments twenty-eight peat bogs, of an aggregate area of 200,000 dessj (540,000 acres), and peat deposits amounting to 14,250,000 poods (400,000 tons), have been examined. The peat-fuel industry is particularly developed in the central Governments of European Russia, and is principally worked by various concerns for their own requirements. The Governments of Moscow, Vladimir, Nishny, Rjasau, Kostooma, Tambow, Twer and Kasou produced an aggregate of 146,964 cubic sashes (573,159 tons) machine-made peat fuel in 1908; 219,716 cubic sashes (856,922 tons), in 1909; and 242,744 cubic sashes (946,701 tons), in 1910; by far the greatest portion of the production being credited to the two first mentioned Governments. The quantities of hand-made peat fuel during the same period was as under: 91,600 cubic sashes (357,240 tons) in 1908; 38,400 cubic sashes (149,760 tons) in 1909; and 52,421 cubic sashes (204,442 tons) in 1910. Taking the average weight of a cubic sash of air-dried machine-made peat fuel at 240 poods, the consumption of peat fuel in the eight Governments mentioned above amounts to an aggregate of 33,850,000 poods (940,300 tons), of which 21,200,000 poods (600,000 tons) relate to the Government of Moscow. As the production amounted to some 58,000,000 poods (1,611,000 tons), a balance of about 24,000,000 poods (666,600 tons) remained. At the time when the price for masut was raised several factories expended large sums on the purchase of peat deposits and installations for manufacture of rational peat fuel. During the year 1910, 64,000 cubic sashes (236,800 tons) came from bought peat deposits, 49,571 cubic sashes from rented deposits, and 128,573 cubic sashes (987,720 tons) from deposits of mixed proprietorship. The price for peat fuel appears to vary from 8 to 12 kopeks (2d. to 3d.) per pood, while the cost of air-dried machine-made peat fuel shows a remarkable margin from 8 roubles 35 kopeks (16s. 9d.) to 24 roubles 60 kopeks (2£ 9s. 2d.). Reckoning with the average cost of 13 roubles 66 kopeks (1£ 7s. 3d.) per cubic sash (3.8 tons) of finished peat fuel, the cost per pood of peat at the places of production comes out at 5.7 kopeks (1½d.); putting the cost of transport from the deposits to the factory at 1.1 kopeks (¼d.), a pood of peat fuel would cost about 7 kopeks per pood (9s. 5d. per ton). Con-

sidering that masut, in the year 1910, cost 39 kopeks (10d.) per pood in Moscow, 28 kopeks (7d.) in Nishny, and 34 kopeks (8½d.) in Vladimir, and that 3½ to 4 poods (126 lbs. to 144 lbs.) of machine-made peat fuel should have the same heating value as 1 pood (36 lbs.) of masut, the latter fuel, with present prices, cannot compete against peat. The working periods on the peat deposits last 85 to 90 days, generally starting at the beginning of May and lasting until the middle of September. In Central Russia some 20,000 hands are employed in the peat industry, the output for each being an average of 2,688 poods (41½ tons) of peat fuel. The great drawback with air-dried peat fuel is its large percentage of moisture.

Peat in Canada. The following item appeared in the Gas Industry of February, 1912:

"So important has peat become in Canada that a Canadian peat society has been formed which issues a journal devoted to peat. This gives information about Canada peat which may be of more than ordinary interest. Some idea of its possibilities may be gained from the estimate that 28 acres of peat 9 feet deep should yield 50,000 tons, enough fuel to supply a hundred families for 25 years, allowing 20 tons per annum to each family, or enough to furnish a power plant of 100 horsepower using steam engines, with fuel for more than 25 years of 300 ten-hour days, allowing 12 pounds of fuel per horsepower hour developed. The fuel, if used in a gas producer, would last the same plant about a hundred years."

Results from the Schweger Moor Power Station. The peat gas power plant and electric station at the Schweger Moor, near Osnabrück, Germany, concerning which so much has been written, was started in regular operation on October 2, 1911. It delivered at the town of Osnabrück, about 30 kilometers away, 286,046 kilowatt hours during October, and 428,870 kilowatt hours during November. Sulphate of ammonia production was begun in the second half of October, and before December 1 there were about 20 tons of this product ready for shipment. The returns which had been promised on the investment by the promoters, on which the expectations of the management were based, have been fulfilled.

The Peat Association of Canada held a meeting at Montreal in January, at which the following officers for the coming year were elected: President, F. W. Rous; Vice President, A. C. McNally; Secretary-Treasurer, P. Leo Smyth. No account of the proceedings of the meeting has yet been received.

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EDITORIAL NOTES.

Peat in Agriculture. It is an interesting fact regarding the literature relating to peat, that while a large part of the actual work of an important nature is being done along agricultural lines, most of the matter which is published in the journals to which the editors have access relates to the use of peat for power and fuel purposes. It is thus evident that the literature of the present day is prophetic, in that it deals with future uses of the peat and not with the present day use. It is in accordance with all progressive scientific and technical work, however, that the literature is ahead of the practice. Philosophically, this should be the proper order, although at times the order is reversed and we get practice before descriptive matter is published.

Nitrogen Content of American Peat Samples. Dr. N. Caro, of Berlin, Germany, in a recent letter regarding some peat samples which had been sent him from this country by a member of the American Peat Society, reports "that the peat can be very satisfactorily used by the Frank & Caro system of gasification and ammonia recovery. The samples give the following results: At 3 ft. depth, 2.20 per cent. of nitrogen; at 5 ft. depth, 1.96 per cent. of nitrogen; at 7 ft. depth, 3.54 per cent. of nitrogen; at 15 ft. depth, 2.64 per cent. of nitrogen. The average amount of nitrogen, therefore, is a high one, so that from 80 to 100 kilograms (176 to 240 lbs.) of sulphate of ammonia per ton of theoretically dry peat could be obtained from the material from which the samples were taken." It is hoped that in the near future Dr. Caro will visit the United States and examine some of the excellent propositions which could be found for the establishment of a peat plant based on his process.

Utilization of Bogs in North America. Under this title the April number of the Electrotechnische Rundschau, published in Potsdam, Germany, gives a very interesting account of the New York Section meeting held at the Chemists' Club on April 9th.

Value of Peat Litter. Reports on comparative experiments with farm manure with different kinds of litter, and extending over a period of eight years, showed that the peat litter gave the largest crops and that it was the most economical. Both peat litter and mixed peat and straw litter in equal parts produced the maximum effect the first year, while the straw litter did not give its maximum effect until the third year after application. The experimental work on which the report is based was done in Sweden, under direction of Mr. S. Rhodin.

A New Peat-testing Laboratory in Germany. A laboratory for the technical and industrial use of peat was opened on October 1st last, at the Technical College at Hanover, Germany. The means were provided by the Prussian Government in 1909. In 1910 the government decided to make this institution a permanent one. The laboratory will be in charge of Dr. Gustax Keppeler, who will also deliver the lectures. It is reported that Dr. Keppeler will attend the eighth International Congress of Applied Chemistry at New York in September.

Use of Charred Peat. It has been reported from reliable sources that one of the manufacturing concerns in the Central

West uses a carload of charred peat every day throughout the year.

The Chemical Engineer, one of the exchanges of this Journal, in its January, 1912, number, had the following papers of interest to our readers: The Volatile Constituents of Lignite, by G. B. Frankforter and Andrew P. Peterson; The Gas-power Field for 1911, by Robert H. Fernald; The Uses of Peat, a Review of Bulletin 16 of the Federal Bureau of Mines, and a note on the work on peat done by the Canadian Department of Mines.

Sulphate of Ammonia Production in England in 1911. The following were the amounts of sulphate of ammonia produced in England in 1911, and the sources of production:

Sources of Supply	Tons
By-products coke ovens	105,343
Gas works	168,783
Producer and carbonizing works	30,000
Shale works	60,765
Iron works	20,000
Total	384,891

This is an increase of 17,389 tons over the production of 1910.

Peat Industries Limited, of Montreal, Canada, expected to make a full season's run during the summer and turn out several thousand tons of air-dried peat fuel. Mr. G. E. Carlsson has charge of the field operations at the plant at Farnham.

Technical Work of the German Peat Society. This progressive society has established a technical branch with Dr. L. Wolff, of Charlottenburg, as Director. The purpose of the new line of work is to make complete and extensive tests of peat as fuel and to examine into the properties of peat for any and all of the uses for which it is adapted, on a scale that will leave no doubt as to its fitness and value for the proposed uses.

Exports of Peat from Sweden. In 1910, 36,609 tons, and in 1911, 38,927 tons of peat were exported from Sweden. (Chiefly as stable litter and mull, presumably.—Editor.)

New German Central Electric Stations. It was reported in the Neue Hamburg Zeitung of December 18, 1911, that two new central stations are projected in the Province of Hanover.

One will be built at the largest single bog area that is found in Prussia, the Burtanger moor, in the Meppen district; the other will be near Bremervoerde. When these two stations are completed the greater part of Hanover will be supplied with the electric energy for power and lighting purposes developed from peat bogs.

Peat Litter Manufacturing Co., Pappenburg, Germany. The largest peat litter plant in Germany can hardly supply the demands made upon it for stable litter. The peat is brought to the plant by water daily, in barges, each bringing about 10 tons of raw moss peat. About 20 barges arrive at the plant in the course of the day and their loads are shreded, screened and worked up into bales as fast as possible. The average shipments amount to about 20 carloads per day. The capacity of the plant will shortly be more than doubled by the erection of new machinery. It is hoped by the management that before the end of the third season the shipments will be increased to 50 or 60 carloads of baled litter daily.

Lignite and Briquet Industry. The production of lignite and briquets in Germany for 1910 and 1911 is reported as follows:

	1910 Tons	1911 Tons
Production of Lignite	12,596,800	14,136,300
Sales of raw Lignite	1,097,700	1,130,600
Self-consumption and quantity worked up	11,590,000	13,007,700
Production of Briquets	3,514,500	4,019,400
Sale of Briquets	3,516,900	4,003,250

Drying Peat. Samples of dried peat of excellent quality have been received from the Mark Process Drier Company. The letter accompanying the samples states that there is no farther uncertainty as to the drying of peat in the company's drier. It can be done without clogging or in any way retarding the process or injuring the product, which, according to the samples submitted, issues from the drier as a fine brown powder.

Russian School of Methods of Swamp Reclamation. The Russian Department of Agriculture has recently founded a school for the training of specialists in swamp reclamation and cultivation at the Riga Polytechnic College. The plan is to admit to this special training school only the best students

from the preparatory schools, on the recommendation of their professors. Those who are admitted to the special courses will receive scholarships paying $38 a month, and during the first year only 25 students will be admitted to the new school.

It is predicted from past experience in the region where the reclamation work will be first undertaken, that many large swamp and marsh areas in northern Russia can quickly and cheaply be turned into a vast region for stock raising, as the drained lands will readily grow large crops of grass of good quality.

Swedish Peat as Fuel. The problem of making Sweden independent of foreign coal has lately been receiving much attention, and experiments have been made with peat from bogs in northern Sweden. The peat was permitted to dry for one summer and then crushed to a fine powder. This is further dried in ovens containing several sections, the hottest section being on top. Heating requires 20 minutes, which makes the pulverized peat black and reduces the water content to 15 per cent. The ovens have a capacity of 25 tons daily, and are fired with the powder, which sells at the factory at $2.27 per ton. It may also be used for boilers, and the state railway authorities are experimenting with it. Generally, however, the tests have not proven satisfactory from an economic and business standpoint.

Dr. T. A. Mighill, of Cambridge, Mass., Vice President of this Society for New England, was granted a patent on January 23, 1912, for an apparatus or machine for turning peat blocks on the drying field. The number of the patent is 1,015,390. The machine is designed to do away with hand labor in turning the peat on the field during the process of drying, and from the simplicity of its construction and the ease of operation, bids fair to materially reduce the cost of producing air-dried machine peat on suitably prepared drying grounds.

California Peat. We are indebted to Western Engineering for the following extract from an article entitled "Fuel Resources of California":

"Peat is known to exist in California, but there is a lack of data regarding it. Its occurrence is in the marshes of Sacramento and San Joaquin deltas, in parts of the Yolo and Sutter basins, throughout the marshes of San Francisco Bay, in the marshes of the Salinas River, and in that part of Kalamath Lake lying in California. Estimates cover 72 million tons

proved in these areas, with possible additional areas containing a billion tons. Peat cannot compete with California oil, and apparently has no immediate value as fuel. It is believed that by the time it becomes a commercial possibility, hydro-electric power will be sold at prices that will render it unprofitable."

The Peat Industry of Russia. In 1908, 73 firms engaged in peat production with an output of 52 million cubic feet, chiefly in the departments of Moscow, Waldimir, Nizhni-Novgorod, Rjasan, Kirtronia and Tambow. In 1907, according to the superintendent of the Moscow mining district, the central industrial region of Russia produced 181,500 tons of peat fuel. In 1908, the quantity produced was equal to 544,500 tons of hard coal, and the number of men employed in the industry was 17,000. The methods of production in use were old and included none of the improved ones used elsewhere in Europe. The peat in the present workings is estimated to meet all demands upon it for at least 50 years, with many deposits yet untouched.

Peat Powder as Locomotive Fuel. The problem of finding a suitable form for peat as a practical and economic fuel for locomotives continues to engross the attention both of railway authorities and peat experts. More especially in Sweden, the problem is an important one; but no satisfactory solution appears to have been arrived at as yet. The general director of the state railway is much interested in the matter and recently submitted drawings of locomotives to a very well known peat engineer for him to design a suitable firebox, which, however, has not yet been done. It would seem that although peat powder may prove a desirable fuel for stationary boilers, the difficulties offered in the use by the locomotive have not yet been met.

Exports and Imports of Peat Coke in Germany, 1909-10-11. The following quantities of peat fuel were reported among the imports and exports for Germany for 1909-10-11:

	Imports	Exports
1909	13,208 tons	23,579 tons
1910	16,188 tons	20,359 tons
1911	14,517 tons	35,855 tons

Newfoundland Peat. At its last session, in 1911, the Legislature of Newfoundland passed an act confirming an agreement with the International Carbonizing Company of England, for the establishment in Newfoundland of a peat manufactur-

ing plant. It will be remembered that this company is the one controlling the Ekenberg process and patents.

The Minnesota Fuel Company is reported by the St. Cloud (Minn.) Times, to have purchased 160 acres of peat land near Janesville, Minn., on which a peat fuel plant will be erected. The machinery and plant are reported to be under construction. Mr. L. B. Lincoln, according to the same item, is superintendent and manager of the new plant and will open offices in Mankato.

Peat in Nebraska. Peat, said to be of excellent quality by the Nebraska State Geological Survey, was reported from near Milburn in that state. The residents of the district say the deposit is a fine one and that it promises to be of much value.

Italian Peat Mond Gas Plant. A correspondent who recently visited the plant of the Società per l'utilizzazione dei combustibili Italiani Milano, at Pontedera, Italy, which has now been in operation more than two and a half years, reports that the Society is constructing a plant combining air and mechanical drying of the peat. The technical results of the plant are reported very good, but it was found that it was difficult, under the local conditions, to keep up the supply of fuel regularly, so that the engineers of the Society have worked out a new plan of mechanically drying the peat. When the new plant is in operation it is hoped to publish an account of it in this Journal.

Executive Committee Meeting. The Executive Committee of the Society held a meeting on Friday, June 15th, 1912. The finances of the Society and the annual meeting were the chief topics of consideration. Provision was made for publishing the Journal for the remainder of the year.

E. V. Moore, of Peterboro, Canada, reported in June that he expected to have his new peat fuel plant near Alfred, Ontario, in full operation by July 1st.

The International Carbonizing Company of London, Eng., which controls the Ekenberg patents, is reported to have purchased a large tract of peat land in Sweden, known as the Dalamosse in Smoland. This bog has an area of about 24 square miles and the purchase price is said to be $1,400 a square mile. The same company bought about 12 square miles of a bog called the Tumemosse, near Jönköping, Sweden, at a much higher price. No announcement has yet been made as to the

purpose of these purchases, but from time to time, for the past two or three years, reports of the purchase of peat deposits by this company have been received and it is fair to assume that the company expects to use them as sources of peat fuel, using the wet carbonizing process to make it.

The Canadian Peat Society is making steady progress and is doing useful work to advance peat industries in Canada and the rest of the world as well. The Society petitioned the Department of Mines to send an engineer to Europe to investigate and report upon the recent installations for generating electricity, gas, and the recovery of by-products from peat. This petition had not been acted upon, but early and favorable action was expected at last accounts.

The Library of the New York Chemists' Club. The Chemists' Club, 52 East 41st Street, New York, through its Board of Trustees at a regular meeting, held June 20th, 1912, extended the use of its fine technical library to the members of this Society. The resolution adopted by the Trustees was as follows:

"Resolved, That the library of the Chemists' Club shall be open to properly accredited members of the American Peat Society at all reasonable hours."

Members of the American Peat Society who wish to use the library thus opened to them, should communicate with the Secretary of the Society to secure identification cards, to properly introduce them to the librarian of the Chemists' Club. Visiting members, as well as those living in and around New York, will find this library of great use.

The Irish-American Peat Association, of London, Eng., has recently favored the Editor of this Journal and some of the members of the American Peat Society, with copies of the Irish Industrial Journal containing numbers X and XI of the series entitled "The Peat Industry," which has been previously noticed in the Journal.

The Ekenberg process is the subject discussed in these two numbers of the series, and a full history of the process, so far as it has been described, together with a list of patents covering the process and the mechanical plant needed to carry it on, is given in Part X. Part XI is a translation of an exhaustive criticism of the Ekenberg process, by Dr. L. Wolff, which was published in Journal of the German Peat Society for 1909, No. 24. These papers are valuable for reference to those interested in the Ekenberg process and can doubtless be

obtained from the officers of the Association, at 47, Great Russell St., London, W., England.

Mr. C. Lindley Wood, a well known English peat engineer, spent several weeks in the United States recently as the representative of the Power Gas Corporation, Ltd., of Stockton-on-Tees, England. Mr. Wood will devote most of his stay to examining a large peat deposit in Florida for a recently formed English company, with a view to its utilization as a site for a gas power and ammonia recovery plant. During his stay Mr. Wood will visit a few of the experimental peat fuel plants and one or more of the peat fertilizer filler plants that are in operation this summer.

It is hoped that some of the results of his work will be available for publication later. Mr. Wood has visited most of the large peat producing plants of Europe, including those where peat is used in large gas-producers near Osnabrück, Germany, and Pontedera, Italy. He has also had long experience in charge of various kinds of peat factories in the British Isles and on the continent. The Editor was so fortunate as to have an opportunity to meet Mr. Wood as he was passing through Washington, and received most encouraging reports from him as to the status of the use of peat fuel in large gas-producer plants of the Mond type in Europe, and especially of ammonia recovery from these plants.

Peat an Unknown Substance. The average well informed American knows nothing of the uses and occurrence of peat. A few people in a thousand, perhaps, have heard or read that the poor peasants of Ireland, Scotland or some other European country burn peat, but what the substance is, how it is prepared, or where it may be found are entirely unknown to them. A very common question when the substance is mentioned in general conversation is, "Is there any peat in this country?" or, more often, "What does peat look like?"

Almost everyone, however, seems interested in learning about peat, when once the subject is presented, and therein lies one of the hopeful signs to those who are members of the Society. The Society was organized to gather and spread broadcast, as widely as the means at its command would permit, the facts about the occurrence, the characteristics and the economic uses and value of peat. This work has now been carried on for nearly 5 years, and although the number of people reached is not as large as was hoped at the outset, if the members of the Society will actively interest themselves in getting others to join them, the time will soon come when peat will not only be known, but used commonly.

REVIEWS AND ABSTRACTS OF RECENT PUBLICATIONS ON PEAT.

(Publications and articles intended for review in these columns should be sent to Dr. Herbert Philipp, Exchange Editor, Perth Amboy, N. J.)

Class I.—Peat Plant and Machinery.

Dewatering Peat. Apparatus for Extracting Water from Coal, Peat and the Like. C. Burnet, Durham, England. English patent 23,215. Oct. 7, 1910.

The material is fed through a hopper into a horizontal, cylindrical chamber, having perforated walls for the escape of water, in which it is compressed by a reciprocating piston; the freeing and compressing means are operated independently, the pressure of the piston being applied when the material is stationary. By means of a ram or similar device, the partly dried material is further compressed at a point near to the delivery end of the chamber, the pressure being exerted during the return movement of the feeding means. (J. Soc. Chem. Ind., Vol. 30, p. 1303.)

Process for Dehydrating Raw Peat. By compression and addition of a porous substance. E. Abresch. Fr. Pat. 434,084. Sept. 9, 1911. See Eng. Pat. 20,145 of 1911. (Jour. Soc. Chem. Ind., 1912, 63.)

Peat Machine. Andrew S. Cairncross, St. Paul, Minn. U. S. Patent 1,019,946. U. S. Patent Office Gazette, 176:2:347-8. March 12, 1912. Comprises a combination of movable support, a pulverizer adapted to disintegrate the surface of the ground, a collector consisting of a rotary brush and conveyor receiving the material from the brush, together with means mounted on the support for operating the pulverizer and collector.

Class II.—Peat Fuel and Briquets.

Machines for Treating, Drying, etc., Peat. A. Kesson, Prestwick, Ayrshire. Br. Pat. 15,326, July 1st, 1911. The peat is delivered into a pulverizer from a hopper fitted with a series of toothed cutting discs, of which alternate members are rotated. The pulverizer itself comprises a horizontal cylindrical casing with four longitudinal shafts extending through it. These shafts carry inclined arms which feed the peat towards one end of the casing, and the arms have spikes to disintegrate the peat. The peat is discharged through rectangular apertures in the end of the casing onto "vacuum trays," where it is supported on sheets of hair-cloth and dried by drawing air through it by means of a vacuum pump. The peat is then cut into blocks by

vertically moving knives as it passes to the elevator which raises it to the drying shed. (From J. Soc. Chem. Ind.)

H. P.

Calorific Power in Peat. H. C. Sherman & C. G. Amend, School of Mines Quarterly, Columbia University, 1911, Vol. 33, p. 30. Comparison is made of the Dulong formula, as modified by Wheeler and Walker, for calculating the calorific value of peat, etc., from the chemical composition, with direct determinations by means of the Atwater-Mahler bomb calorimeter.

The peat was found by chemical analysis to be composed as follows:

Carbon	57.30 per cent.
Hydrogen	4.66 per cent.
Oxygen	19.26 per cent.
Nitrogen	1.13 per cent.
Sulphur	0.77 per cent.
Ash	16.88 per cent.

The calorific values (in calories) of the peat are as follows:

By Welter's Rule	5,422
By Walker's Rule	5,671
Direct Determination	5,606

The authors conclude that Walker's rule, where the oxygen of the sample is calculated as combining with the carbon, is more nearly correct to the direct determination than the other formula.

H. P.

Class III.—Peat Distillation and Coke.

Carbonizing Peat. K. E. Edgeworth. Br. Pat. 18,393 (1911.) Peat is carbonized in a series of carbonizing vessels, each of which may be placed in communication with any other carbonizing vessel of the series, and with a supply of water preferably contained in a series of vessels at different temperatures, and also with a steam boiler of any ordinary construction. The peat is gradually raised in temperature in a series of steps by the carbonizing vessel with a thermal storage tank at a temperature above that of the peat, the said thermal storage tank being at the same time connected with another carbonizing vessel at a temperature higher than that of the water in the said storage tank, so that the peat in the first-named carbonizing vessel is raised to the intermediate temperature of the thermal storage tank. This operation is continued by connection with other tanks in succession until the peat is raised to a temperature of, say, 80° C., after which it is further heated in steps by steam from the carbonizing vessels to a temperature of 140° C.; steam is then admitted from the boiler to raise the

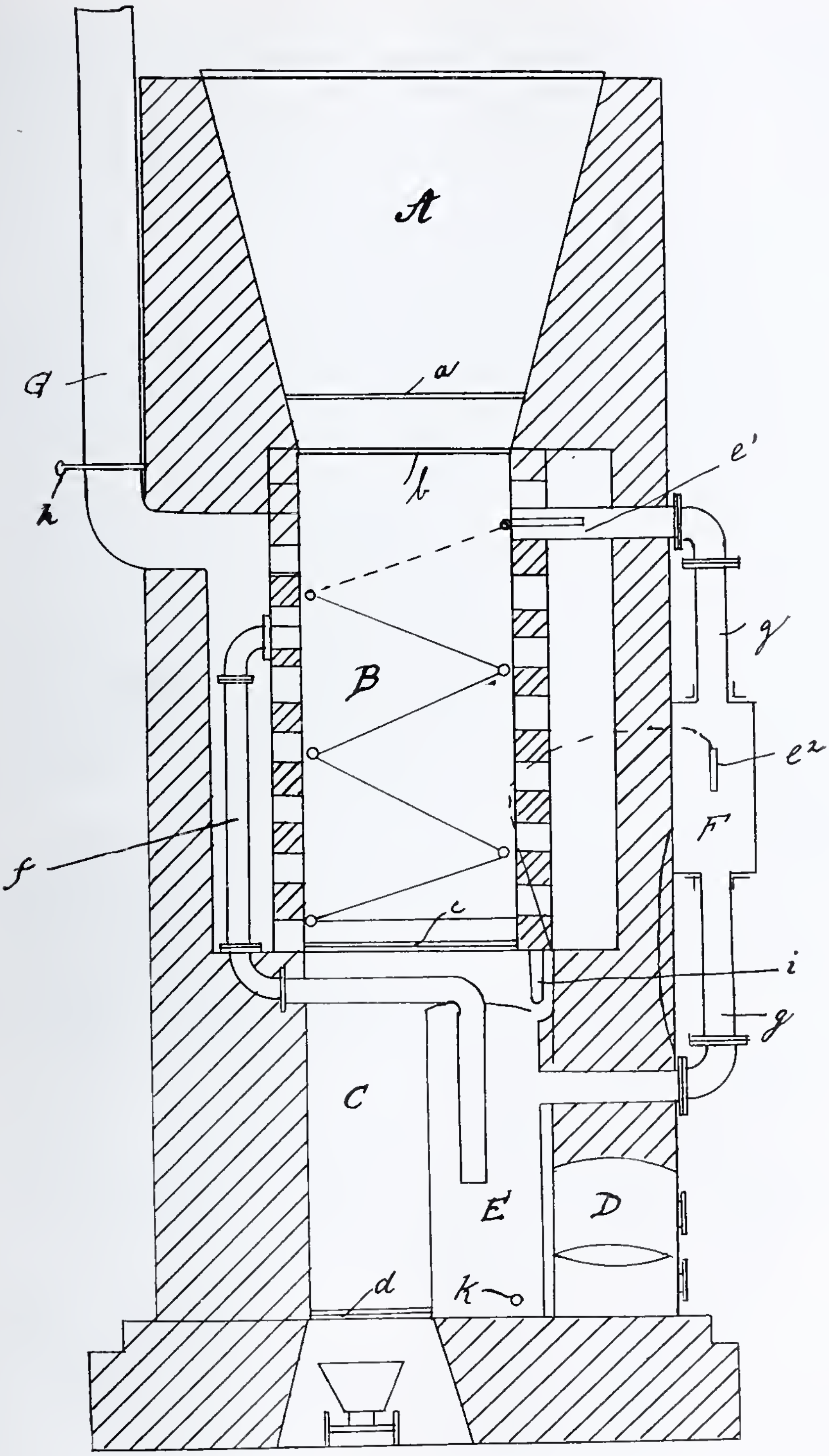

Plate III.—Vertical Section of Wengler's Peat Coking Furnace.

temperature of the peat to 160° C., at which temperature wet carbonizing takes place. The carbonizing vessel is then connected to another vessel containing fresh peat at a temperature of 120° C., so that its heat is used in warming the latter as already described. Its temperature is thereby reduced, and this operation is continued by connection with other vessels until the temperature of the peat is diminished to 100° C., when the process is continued by connecting it to a thermal storage tank at a lower temperature, and in connection likewise with a vessel containing fresh peat at a still lower temperature, the operation being the reverse of that which takes place during the heating of the peat. The step-by-step cooling is continued until the carbonized peat is reduced to a temperature only slightly above that of the atmosphere, when it is removed from the vessel and a fresh charge introduced. H. P.

Peat Coking Furnace. Arthur Wengler, Zwicklau i, S., Germany. German Patent Application St., 13,669. Applied for Jan. 18, 1909. Laid out Oct. 16, 1911. (See Plate III., p. 119.)

A shaft furnace for coking peat, wood or other similar substances, in which steam injectors and an expansion space are provided to increase the velocity of the circulating gases; so designed that the gas collector is placed in the cooling chamber of the furnace, in which the radiated heat from the glowing coke creates sufficient steam and thickens the condensation products.

Description. By the coking of peat, wood or similar substances in a shaft furnace, in order to get an economical yield, it is necessary to lead the gases formed (first by the distillation and finally by the coking) away as quickly as possible, advantageously through suction, so that a complete gasification takes place. For this purpose steam injectors or similar apparatus were included in the gas line, which had to be supplied with steam from an independent source.

The boilers for supplying this have been, up to the present, placed in the coking chamber and heated by the hot gases. By this method it is impossible to regulate the heat, so that very soon after starting the oven, a high pressure develops in the boiler with the danger of an explosion, especially as no air can be allowed to enter the coking chamber and therefore no damper can be used. Furthermore considerable heat is taken from the coking oven, which is not very advantageous for low grade coking products; moreover, by taking this heat away the speed of the coking process is diminished.

To obviate these disadvantages, this invention covers a new furnace, in which a boiler in the coking chamber is unnecessary, as the necessary steam for increasing the velocity of

the gases is supplied from a container placed under the coking chamber, which also serves as a gas collecting space.

The figure shows, in vertical section, a mode of carrying out this invention, all the armatures of the oven not being shown.

The furnace itself is the well-known shaft furnace, with a hopper **A**, gates **a b**, the coking chamber **B** and the cooling chamber **C**, in which the glowing coke, let in by the gate **c**, is allowed to cool until it can be taken out at gate **d** and used for other purposes. In this cooling space, where there is always a comparatively high temperature on account of the amount of coke being cooled off, is placed the gas collector **E**, which is heated more or less according to the coke contents of the fuel treated, and on account of the heat taken away by the gas leads to the quicker cooling of the coke. A regulation of the production of steam is made possible by arranging the rate of the heat radiation from the coke.

Through the gas collector **E** pass the gases containing steam and heavy carbo-hydrates from the pipe **g**, which is provided with steam injectors e_1 e_2 to accelerate the velocity of the gas, and an expansion chamber **F**, which facilitates the separation of the condensible from uncondensible products. By placing the gas collector **E** in the cooling chamber **C**, it has an additional advantage, as it saves the distillation of the water from the condensation porducts, which, on account of the heat from the glowing coke, thickens the condensation products, which are let out through the opening **k**. The water which has condensed in the pipe **g** is vaporized in the kettle **E**, and creates thus the acceleration of the velocity of the gases by the injector principle, and thus obviates the necessity of introducing a special boiler for this purpose. The non-condensible carbo-hydrates pass through the tube **f** to the coking chamber **B**, and there play their own part in the distillation of the material, which is started by the auxiliary fire at **D**. H. P.

Class IV.—Peat Gasification.

The Utilization of Peat by the Production of Power Gas and Ammonia. A. Frank. Jour. f. Gasbeleuchtung, 1912, Vol. 55, p. 49.

The consumption of peat compared to other fuels shows a steady decline. The reasons are the uncertainty of the supply, the difficulty of storing the voluminous material and the easy deterioration by atmospheric conditions. Further, the burning of peat on most industrial grates is almost impossible on account of its voluminosity. The author takes the stand that the industries must move to the peat bog to defray freight

costs. He induced capitalists to invest money to erect a plant at Mont Cenis (near Sodingen) to experiment with peat according to the Mond Process and thus produced power-gas as well as ammonia. The experiments showed that peat with 50 per cent. water gave power gas on a commercial scale, whilst gaining also 53 pounds ammonium sulphate per long ton dried peat. The gas consumption was estimated at 85 cubic feet per effective horse power, when the gases contained 36-39 per cent. combustible matter.

As the results of these tests the "Hannoversche Kolonisations und Moorverwertungs Gesellschaft" of Osnabrück have advanced enough money to erect a large plant at Papenburg. The purpose of the plant is to provide Osnabrück and vicinity with electric energy. The ammonia will be recovered from the gas as ammonium sulphate. The stripped peat deposits will be given out to colonists for farming. H. P.

Peat Producer Gas. B. F. Haanel. Jour. Can. Peat Soc., 1911, Vol. 1, p. 8. In an illustrated article entitled "The Peat Producer Gas Power Plant at the Government Fuel Testing Station," the author describes the Koerting Gas producer at the Canadian Government plant located at Ottawa, and also describes its operation when using peat with 30 per cent. moisture. In the tests on various peats, it was found that peat containing 15 per cent. moisture had too little water for satisfactory operation, as the producer was designed for peat with 25-30 per cent. water, and therefore had no way to supply steam.

The author estimates fuel cost per brake horse power year, from a peat gas producer of this type (peat at $2 per ton) at $7.50; from a gas producer (coal at $4 per ton) at $9, and from steam boiler plant, with coal at $4 per ton, at $36. H. P.

Suction Gas-Producer with the Recovery of By-Products for Bituminous Coal, Peat, Etc. A. Koch. Braunkohle, Pol. 10, p. 518.

The author describes the Mueller suction gas-producer with the recovery of by-products. This generator, which is built for bituminous combustibles, gets rid of the tar, not by burning it, as in the double-zone gas-producers, but by cooling, whereby it is condensed together with the ammonia water, and can then be worked into commercial products. Author states that he obtains thus a cleaner gas and, further, a more economical plant. H. P.

Peat Moss. Process and Apparatus for the Treatment of Peat Moss for the Manufacture of Paper and Cardboard. A. Remmer and M. Wolsky. French Pat. 431,360, May 17, 1911.

The moss is treated, first with a dilute alkali solution to

neutralise the carbonic acid and hydrogen sulphide it contains, and secondly with a solution of alum. The refrigerating effect occurring in the course of this treatment is said to facilitate the separation of the methane and other gases occluded in the material. These operations are carried out in a paddle washing machine having a sieve-like false bottom. The paddle blades are concave in shape and are enclosed in a drum made of wire netting. (J. Soc. Chem., Ind., 1911, Vol. 30, 1,376.) H. P.

Vararbeitung von Torf. Chem. Zeit, 1895. No. 95, p. 2128. D. R. P. 83,332; 28 Mar., 1895. M. M. Rotten, Berlin, Method of separating fibers from peat for paper making, etc. Divides the peat substance into fibers, mud and heavier plant remains. Fibers sieved and washed to separate the fine stuff.

Class VI.—Peat Fiber and Litter.

The Production of Peat Litter. J. Rasmussen. Hedeselskabets Tidsskrift, 1912, p. 76. H. P.

The Examination of Peat Bedding and Peat Dust. Dr. W. Bersch (Austria), Z. landw, Versuchsw, 14:1343-8. Directions for sampling the peat and for the determination of the moisture content, the water-absorbing capacity, and the total ash, nitrogen, potash and phosphoric acid are given. These are all to be looked for if the value of the bedding in the manure is in question.

To determine the water-absorbing capacity, 30 grammes of the peat, in which no pieces should be larger than about 2 c. m. (¾ inch) in diameter, are covered with water at room temperature, and the air is exhausted from the vessel to secure thorough penetration of the water, after which the peat is left to stand for three days at ordinary pressure. After this time, the peat is taken from the water and allowed to drain in a wire basket, lined with filter paper and set on an incline of about 30° until it requires a minute for a drop of drainage to collect. The absorption is computed on the dry basis and also on the basis of the peat as received, or in case of fresh peat, upon the basis of the peat with 30 per cent. of water. (Chem. Abst. 6: 2130.)

Class VII.—Peat Deposits and Soils.

Sugar Beets from Peaty Soils. Vaclav Vilikovsky. Chem. Listy, Vol. 6, p. 49. Sugar beets grown on peaty soils are not only poorer in sugar than those on other soils, but they also yield a larger proportion of molasses. The latter fault is due to their unusually large content of the objectionable nitrogenous compounds; their ash contained abnormally large amounts of chlorides and sulphates, which seem to interfere with the

crystalization of the sugar, and therefore to increase the amount of molasses. A direct relation exists between the amount of nitrogen in the soil and the amount of objectionable nitrogen in the beets. (From Chem. Absts.)

Class IX.—Peat Filler.

Peat Filler. E .H. Jenkins and J. P. Strut. Conn. Agri. Expt. Sta., 1911. Results are given here regarding the soluble organic nitrogen in various raw materials, as are also results of pot experiments with oats and millet. Peat, testing 2.81 per cent. nitrogen, was used in mixed fertilizers and showed in the best case only 6.3 per cent. nitrogen recovery.

According to Street's alkaline permanganate test for organic nitrogen, samples of peat tested, showing a solubility varying from 23.2 to 50.0 per cent. soluble organic nitrogen. H. P.

Facts About Fertilizers. W. I. Chamberlain. The American Fertilizer, 1912, Vol. 36, p. 37.

The author is profoundly convinced that the apparently hostile attitude of many state chemists and experiment station officers and agricultural writers and institute lecturers towards fertilizer manufacturers is both unjust to the manufacturers and harmful to the farmers. For example, he has noticed their frequent insinuations, and even outright statements, that manufacturers dishonestly mix large amounts of some worthless outside "filler," or "make-weight," that they are tricky, that they charge exorbitant prices for factory-mixing, etc., that they do not understand how to mix ammonia, phosphoric acid and potash to meet the needs of soils and crops as well as average farmers themselves do, and that dry or home-mixing pays enormously, etc., etc.

The author thinks some of our "chemists" and State inspectors of fertilizers and directors of experiment stations and agricultural writers and institute speakers, who know little or nothing of the facts and business end of fertilizer manufacture, have done great harm both to manufacturers and to farmers by their apparently hostile attitude, by assuming or implying by their language that fertilizer manufacturers are "sinners above all them that dwell in Judea." H. P.

Liming the Soil. John B. Abbott, Indiana Agricultural Experiment Station. Circular No. 33, 1912.

This circular treats with the liming of Indiana soils, with special reference to soils growing alfalfa and legumes. H. P.

Class XII.—Miscellaneous Abstracts.

Turf Cutting in Switzerland. The Irish Industrial Journal, 1911, Vol. 2, (No. 47) p. 7.

There have been numerous attempts to utilise turf in Ireland, and many of them have produced good results, but none of them, so far, seem to have been commercially successful. This is shown by the fact that none of them have lasted and flourished. If they had paid, they would have prospered. In other words, the expenses have been too great and have left no profits. On the other hand, it appears that peat in some form can be sent from Germany to Ireland at a profit. The only possible explanation is that the process of manufacture is cheaper.

The author found the method of drying the cut turf, or sods, was quite different from the Irish. In Ireland the sods are cut and left to dry on the spreading ground in a single layer, necessitating a large spreading ground, which itself is generally damp; sometimes the sods were after a time placed on end, three sods being put together leaning on each other. Switzerland is a country with a dry climate, but very subject, like all mountainous countries, to sudden violent rain storms, keeping the ground wet, so that laying sods on it would be useless. Under these circumstances, or for other reasons, the mountaineers had adopted another plan of drying their turf. All over the spreading ground were planted a number of stout sticks, standing upright, about a yard apart, and round these the sods were built, two at the bottom, one each side of the stick, then two above them at right angles, and so on, till the pile of peats round the central stick was about three feet high or more, and looked like a small square chimney. H. P.

European Peat Societies. A. Anrep, Jr. Jour. Can. Peat Soc., 1911, Vol. 1, p. 23.

The existing peat societies of Europe are given, showing their yearly grants from their respective governments, and also membership and date of organization. H. P.

Peat Production in the U. S. in 1910. Reviewed in Zeitschrift fur angewandte Chemie, 25:15:721-722. Article is a review of the U. S. Geological Survey publication abstracted from Mineral Resources for 1910, and is discussed under two heads: A General Discussion of the Peat Situation; and Peat for Fertilizer Filler in 1910.

Electric Power Application on the Farm. Frank Koester. Electrical Review and Western Electrician, 60:16:743-746. Ill. The article describes various forms of electrical agricultural implements and especially gives figures and cost relating to electric power, also describes electrically operated refrigerating plants. It is especially interesting because of the extensive use which is being made of electricity as a motive power in farming operations in the moor reclamation enterprises in Germany

where the peat is converted into electric power by the use of the gas-producer in central power stations.

Peat in the United States. Charles A. Davis. Power, 34 (1911), p. 915. Ill. A paper read at the Fuel Conference of the New York section of the American Chemical Society and other chemical societies, in New York, November 10, 1911.

Process for the Manufacture of Peat-Molasses Food by the Addition of Alkali. E. Joseph, Berlin, Germany. Ger. Pat. 241,380, Apr. 14, 1909. Caustic alkali is added to the peat for the purpose of partially separating the liquid, which will contain the formed humic acid salts, and separating the same. Thus a more desirable animal food material is obtained containing very little salt. The liquid can be separated by any convenient method. H. P.

The Aktiebolaget Tourbiere of Stockholm, Sweden, which was formed in 1906 with a capital of 170,000 Krone for the production of alcohol from peat, has dissolved, without ever having been in operation. (Chem. Ztg., 1912, Vol. 36, p. 239.) H. P.

Peat Utilization. Chem. Ztg., 1912, Vol. 36, p. 262. A memoir regarding peat culture and the peat deposits in Prussia has been sent by the Minister of Agriculture to the Prussian Chamber of Deputies.

Therein is reported the extent and quality of the Prussian peat, pre-historic peat culture, the more modern activity in the field and its successful results. To assist enterprising investigations, financial assistance of the State will be forthcoming if necessary. For the purpose of introducing improvements organizations will be established, with experts to devote themselves entirely to these problems. The Province of Hannover will be the first to be systematically proceeded with. H. P.

Peat in Russia. Power, 35:7:218. Russia's peat industry had 78 firms engaged in the production of this fuel; they put out peat fuel which was the equivalent of 544,500 tons of hard coal in 1908. It is stated by Coal Age that Russia's peat deposits are sufficient for all demands for at least 40 or 50 years.

The Uses of Peat. Chemical Engineer, 15: (1912) 1:19. A short descriptive review of Bureau of Mines. Bulletin 16.

Subject List of Works on Peat, etc., in the library of the Patent Office (British), 104 pages, 1911. Price 6d.

Engineering for Land Drainage. A manual for the reclamation of lands injured by water. By Charles G. Elliott, C. E. 12 mo., xvi, 339 pages. 60 figures. Cloth, $2.00 net. New York. John Wiley & Sons. This work has a chapter on the drainage of peat and muck lands and is a most complete little treatise on all problems relating to the handling of drainage operations for all sorts of lands.

Journal of the American Peat Society

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THE PRODUCTION AND UTILIZATION OF PEAT FOR POWER PURPOSES WITH SPECIAL REFERENCE TO THE KORTING PEAT PRODUCER-GAS POWER PLANT INSTALLED AT THE FUEL TESTING STATION OF THE DEPARTMENT OF MINES, OTTAWA, CANADA.*

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The active interest taken by the Canadian Government in assisting the exploitation of peat bogs and the establishment of a peat fuel industry on a firm commercial basis was prompted by the dependence of the central provinces of Canada on some foreign source for their fuel supply.

This dependence is due to an absence of coal measures; the rapidly decreasing supply of wood, which can no longer meet the demands for industrial and domestic purposes; and finally, the prohibitive cost of hauling coal from our own mines—situated in the extreme east and west—to distributive points in these provinces.

But while this portion of Canada is devoid of bituminous or

*The outline of this paper was read at the Annual Meeting in New York, but the paper in full was presented at the 8th International Congress of Applied Chemistry, which took place on the same date. We therefore reprint the same in its entirety from the Congress Transactions.—Editor.

anthracite coal measures, large areas are covered with peat bogs which contain peat of excellent quality, eminently suitable for the manufacture of peat fuel. If all the peat bogs possessing the requisite qualities were exploited for the manufacture of fuel, the demand for both domestic and industrial purposes could be met for years to come, and the Provinces rendered independent of outside sources for a fuel supply.

The assistance rendered the development and exploitation of these peat bogs by the establishment of a demonstration peat fuel manufacturing plant erected on a bog acquired by the Government, and the installation of a peat producer-gas power plant at the Fuel Testing Station, Ottawa, has already borne fruit, by awakening general interest in the possibilities of utilizing peat fuel for power and domestic purposes and since these demonstration plants erected by the Government were purchased—after exhaustive investigation by competent engineers—they may be regarded as examples of the most successful and economic methods for the manufacture of peat fuel, and its utilization for power purposes.

The experimental work done by the Canadian Government has led to most gratifying results, especially in the case of the producer-gas power plant, where much original work—involving the complete reconstruction of the plant—had to be done before it could be pronounced a success. For this reason, a description of the process employed for the manufacture of air-dried, machine peat fuel, and its utilization for power purposes, in what I believe to be the only producer-gas plant on this continent especially designed for, and successfully using, peat fuel, may not be without interest.

Manufacture of Air-Dried Machine Peat.

The raw peat contained in the average well-drained bog cantains from 85-90 per cent of water. Before the peat taken from the bog is suitable for burning, the greater portion of the water must be removed.

Many processes have been invented for drying peat and manufacturing it into a suitable fuel; but the majority of these processes have depended upon drying by the application of artificial heat, and for the mechanical expulsion of the water by means of powerful presses. Such processes are not economic, as costly and exhaustive experimentation has demonstrated.

At the present time the only economic and successful process for manufacturing peat fuel is that which mechanically treats the raw peat, and utilizes the sun's heat for drying. This process is employed at the Government peat plant, Ottawa.

The raw peat excavated from the bog is fed into a pulping mill, which consists of a series of revolving knives, rotating against fixed knives. By means of the mechanical treatment to which the peat is subjected in the mill, the peat from the different layers of the bog is mixed, and the cell walls broken up.

By thoroughly mixing the peat from the different layers in the bog, a homogeneous peat mass results, and the destructions or breaking up of the cell walls enables the contained moisture to evaporate more easily. The quality of the fuel depends on the thoroughness with which these processes are carried out.

After thorough pulping, the peat is taken to the drying field, where it is spread out, and cut into blocks of suitable size. The surfaces of the peat blocks are now exposed to the wind, and the sun's heat; and when drying on the exposed side has proceeded far enough, the blocks are turned over, thus exposing the under surface to the sun and wind also.

The following are a few of the advantages resulting from the pulping of the raw peat:

(1) Increase in density, and greater resistance to breakage.

(2) The formation of a gelatinous skin over the surfaces of the peat, which renders it practically waterproof, and prevents the absorption of moisture from without. The usual explanation advanced for this phenomenon is that the skin swells during damp or rainy weather, and closes its pores, which prevents the moisture from entering the interior. In dry weather, these pores open again and the drying process continues at practically the same content of moisture which the peat had before the rain.

(3) Loss in manufacture—due to fines, broken blocks, etc. —is reduced to a minimum.

In addition to the above advantages resulting from this method of manufacturing peat fuel, it has been demonstrated in our manufacturing operations—covering a period of over two seasons, during which time over 3000 tons of peat fuel were manufactured—that the fuel can stand handling and long transportation without breaking, and indefinite storage under cover.

Over 15 tons of peat fuel were piled in the open air, exposed to rain, snow, and severe freezing during the autumn, winter, and spring, at the end of this time, examination showed that no appreciable deterioration, of its physical properties, or heating value, had taken place.

Moisture.

By open-air drying the moisture content is reduced to 25-30 per cent, and it does not appear to be feasible or economical to reduce the moisture content further. Air-dried machined peat, when ready for the market, for domestic or indus-

trial uses, is, therefore, assumed to contain from 25-30 per cent moisture.

Disadvantages of the Process, as Carried on at the Government Plant.

The peat supplied to the peat machine (pulping mill) is dug entirely by hand. This entails the labor of seven men. For filling the cars, one man is employed, while for spreading and cutting the peat three more men are necessary. This number of laborers—together with one engineer, and two boys—brings the total up to 13.

Under the existing condition of the high cost of labor, this hand labor method cannot be employed for the manufacture of a fuel sufficiently cheap to stand the cost of considerable transportation, and still compete with coal on the open market. The estimated cost of one ton (2000 lbs.) of peat fuel, containing 25 per cent moisture, I have estimated to be $2.00,—including interest on capital, sinking fund, repairs, and a small profit of about 15 cents per ton. But this only holds true when the plant is operated at full capacity, namely, 30 tons per day, for a period of about 100 days.

To overcome the disadvantages due to labor conditions, we have recommended that the process be carried out by automatic machinery, as far as possible. The excavation and spreading—the two items involving the largest amount of labor—should be performed automatically. In addition, the output should be increased, and the plant worked night and day, in order to further reduce the overhead charges.

These recommendations have been taken advantage of by a company who are now installing a plant of large capacity, in which hand labor will be largely replaced by mechanical appliances.

Gasification of Peat Fuel.

By far the most extensive field for the successful utilization of peat in Canada, is in my opinion, offered by its conversion into power—electrical or otherwise—through the medium of producer-gas power plants. On account of the large volume of peat fuel, and its low-heating value, it cannot be recommended for steam-raising purposes.

The high percentage of nitrogen contained in the Canadian peat bogs so far examined, peculiarly adapts the peat for gasification in plants designed for ammonia recovery. And since the imports of artificial fertilizers are annually increasing, the recovery of the nitrogen in the peat, as ammonium sulphate, is not only most important, but should be attempted wherever it is possible to do so economically.

Types of Producers.

There are two principal methods at present employed for the utilization of peat in gas producers:

(1) The direct conversion of the heat energy of peat into work by its gasification in a producer not constructed for recovery of by-products; hence a producer designed to burn the fuel with the highest possible thermal efficiency.

(2) The conversion of the heat energy of peat into useful work by its gasification in a producer designed for the recovery of the commercial by-products. The production of power gas might, in this case, be termed the by-products.

The first type—that designed for the direct conversion of the heat energy of peat into useful work, where the principal aim is the production of power gas with the highest possible thermal efficiency—is the one most commonly in use. To this type belongs the Körting peat gas producer erected at the Fuel Testing Station, Ottawa.

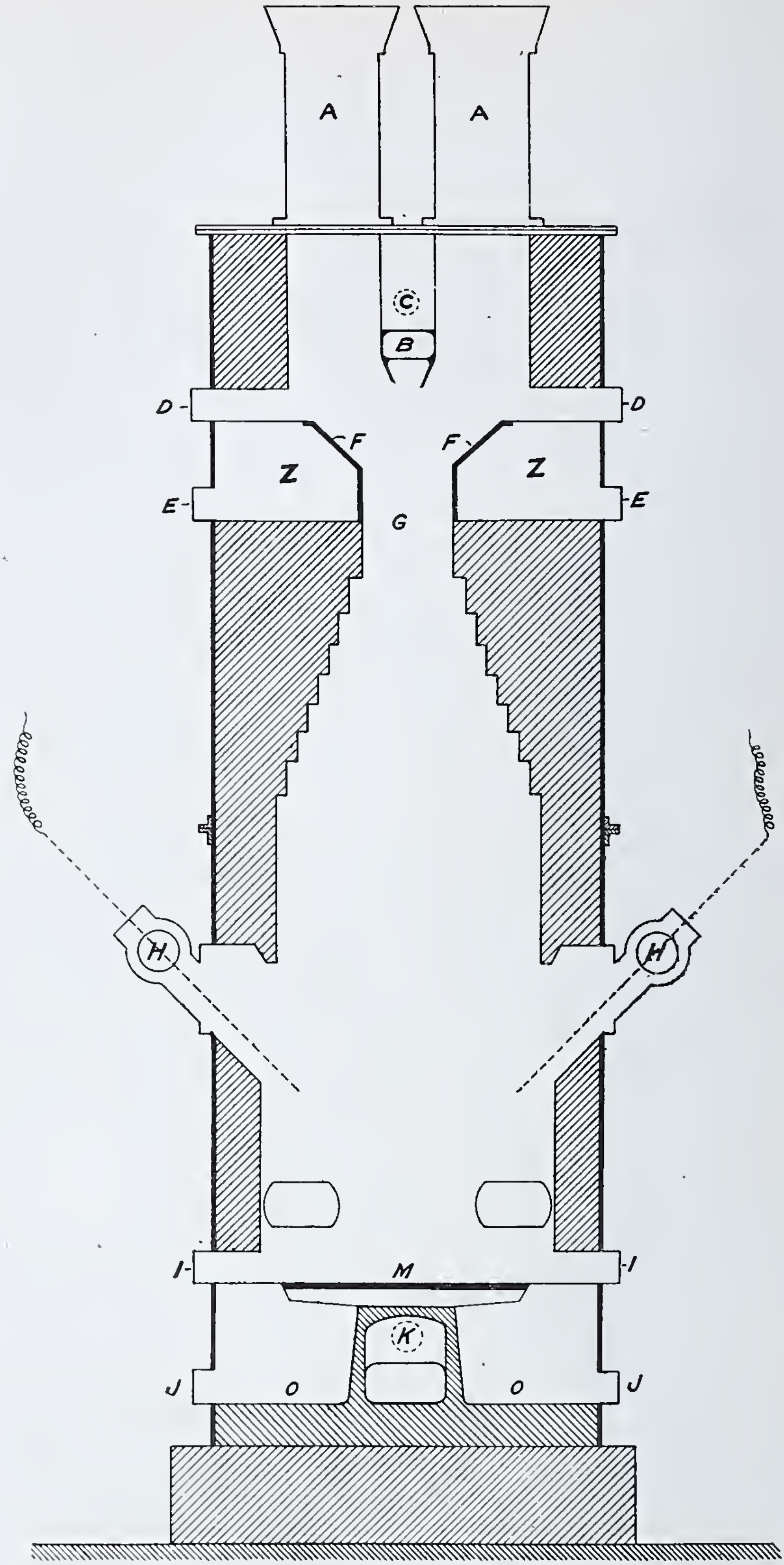
In designing this producer, the makers aimed at the complete gasification of all the combustible components in the peat; no attempt being made to recover any of the by-products, but rather to destroy them.

The small percentage of fixed carbon, large amount of volatile matter, and the comparatively large amount of moisture contained in the peat it is desired to burn in the producer, renders this fuel more or less difficult to use successfully in producers designed for either bituminous coal, or lignite, although some of the properties of lignite closely resemble those of peat. Peat, moreover, is a very poor conductor of heat, and this negative property, together with the high moisture content, tends to confine the combustion in a down-draft producer to the peat near the lining. Hence it is impossible to maintain the fuel level to insure the required depth of hot peat coke through which to pass the volatile matter and moisture driven off at the top, or, to supply the requisite quantity of gas per square foot of grate surface.

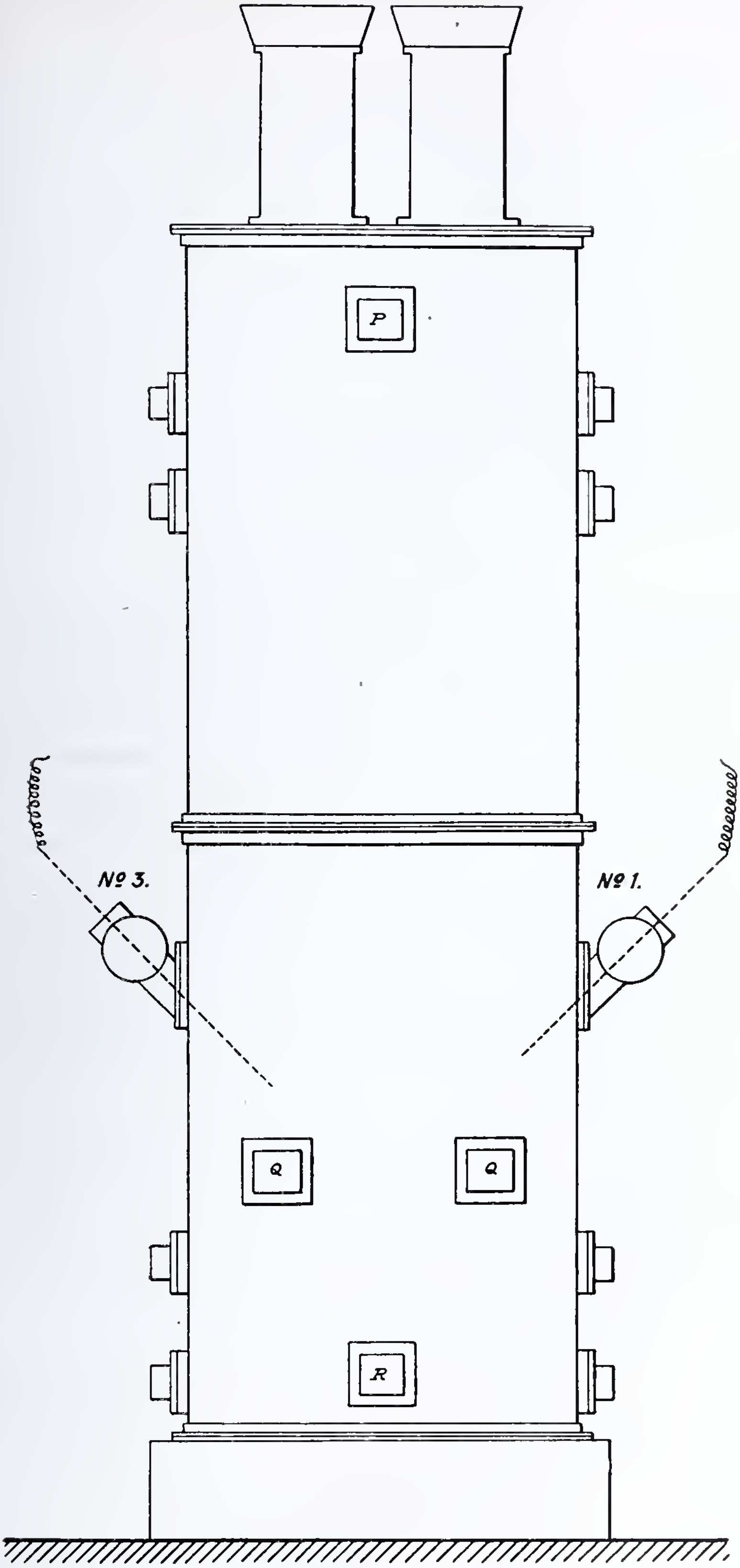
This can be partially overcome by introducing a supply of pre-heated air into the center of the fuel bed: thus increasing the surface of combustion.

Korting Peat Gas Producer.

The difficulties enumerated above are overcome in the producer designed by the Körting Brothers. In this producer two combustion zones are employed: one situated near the top, and the other near the bottom of the producer. The function of the top zone is to distill off the volatile matter, and to evaporate the moisture from the peat. As a result of this opera-



Sectional elevation through A-A.
Fig. 2.—Korting Peat Gas Producer.



Rear Elevation.
Fig. 2.—Korting Peat Gas Producer.

tion the peat is coked, and this coke is then fed to the lower zone. The gases, hydro-carbon vapors, and moisture evolved in the upper zone, are now caused to pass through the hot peat coke in the lower zone.

It was expected that these products of the distillation of the peat in the upper zone, by being passed through the incandescent peat coke of the lower zone, would result in a producer gas free from tar.

In practice, however, this has not been realized in the experiments conducted with the Körting producer. A certain quantity of tar was always found to leave the producer with the gas, and required to be separated out by a suitable cleaning system.

Description of Producer.

The producer, as originally erected, is shown in section and elevation, in Figs. 1, 2 and 3, and in perspective in Plate 1. It consists of a rectangular steel shell with the following outside dimensions: 2′-9″ x 5′-2″, in horizontal section, and 15′-0″ high, from floor level to top of charging hoppers. For cleaning fires and removing ashes, 12 doors are provided: 4 on each side, and 4 on the back. These doors are shown on Plate 1.

Figure 2 shows the two combustion zones F-F at the top, and M at the bottom. F-F represents inclined grate bars: and D-D doors for poking and cleaning the fires resting on the grates F-F. The ashes resulting from the combustion of the fuel on these grates drop into the chambers Z-Z, and are removed from the doors E-E. The gases evolved at this zone are drawn off through the chamber B. The dust and tar which are caught in this chamber are removed through the door P on the back of the producer, as shown in Fig. 2. A-A represents charging hoppers.

M, on Fig. 1, represents the grate bars of the lower zone, and I-I the doors through which the fires of the lower zone are poked and cleaned. The fire above the grates of the lower zone is poked through the doors Q-Q, as shown in Figs. 2 and 3. The ashes resulting from the complete combustion of the fuel in this zone fall through the grate bars into the chambers O-O, and are removed through the doors J-J.

The products of combustion in the upper zone are drawn off through the chamber B, through the pipe C, and vertical pipe V, shown in Fig. 3, to chamber K, Fig. 1; when they pass finally through the fuel of the lower zone to the two gas offtakes H-H, Fig. 1.

S, on Fig. 3, at the top of vertical pipe V, is a damper which is opened to allow the gases resulting from the combustion of the peat to pass into the atmosphere—when the pro-

ducer is standing idle. The damper T—also shown in Fig. 4—is closed while the producer is standing idle; but it is opened and the damper S closed when the producer is in operation. These two dampers are provided with cover plates, which can be readily removed when it is necessary to remove from the damper chambers any material which has collected therein. The vertical gas pipe V, is cooled by means of cold water continually circulating in the jacket U. The cooling water enters at the bottom of this jacket, and overflows at the top to a water seal W, which covers the open bottom of the vertical pipe V.

The ashes which fall through the grate bars M into the gas chamber K—shown in section in Fig. 1—are removed through door R shown in Figs. 2 and 3.

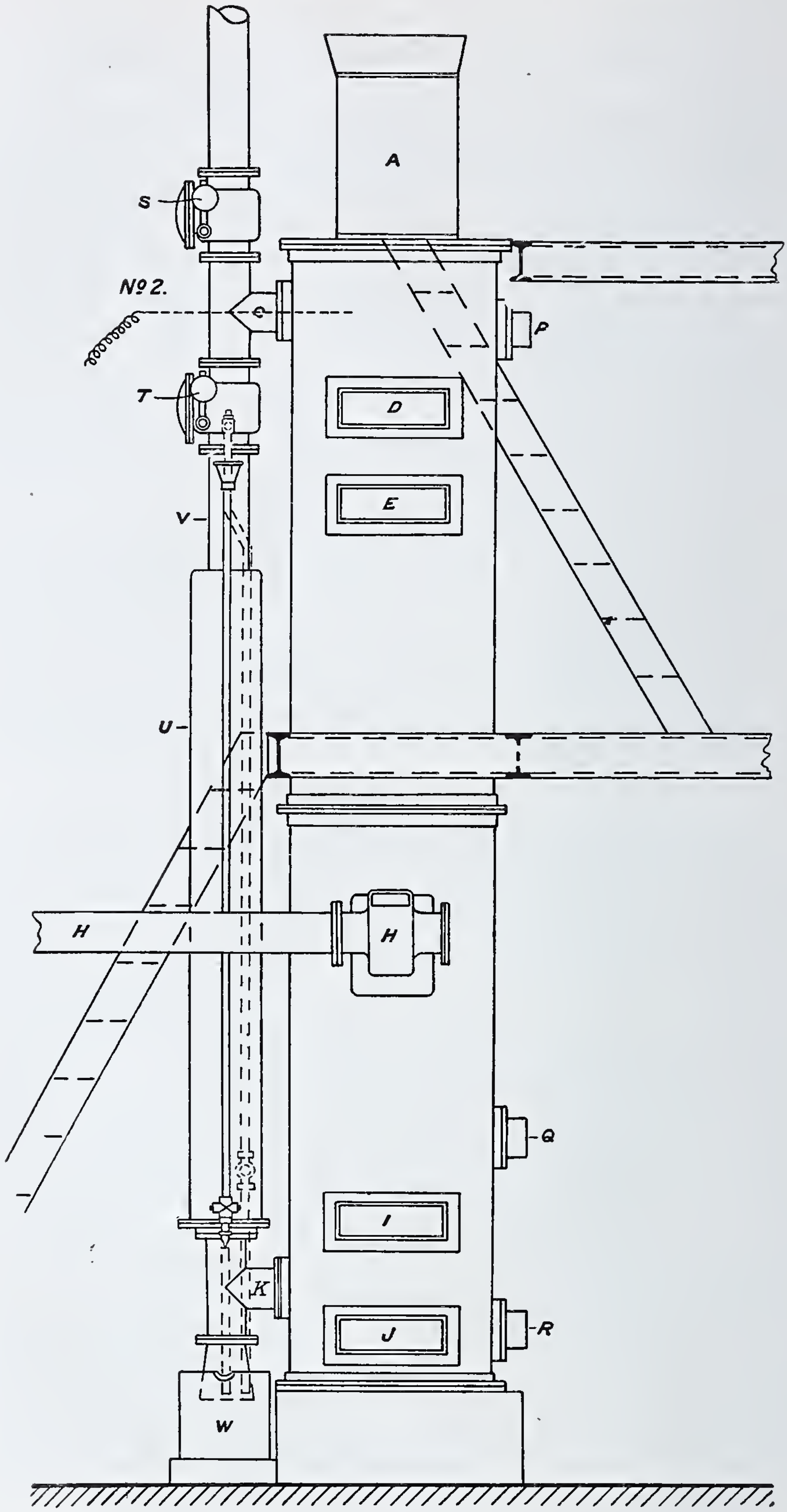
The off-takes H-H, shown in Fig. 1 are provided with caps held firmly in place by clamps, which may be removed for the purpose of inspecting the interior of the producer, at this point, or, for the purpose of removing any dust or tarry matter which may collect in the gas chamber.

For the purpose of regulating the amount of air entering the producer at the top and bottom zones, two adjustable air-openings—not shown in the figures—are provided on each of the doors E-E and J-J.

Principle of Operation.

When the producer is in the proper condition for operation, that portion between the lower grate bars M and the grates F-F (Fig. 1) of the upper zone, is completely filled with peat coke, i. e., peat free from moisture and volatile matter. That portion of the producer between the upper grate level and tops of hoppers A-A, is filled with peat fuel. The function of the upper zone consists in driving the moisture and volatile matter from the peat which supplies the lower zone. To prevent, as far as possible, the products of combustion of the upper zone from being drawn by the suction of the gas engine straight down through the producer and out through the off-takes H-H, instead of being drawn out through C and then having to pass up through the incandescent fuel in the lower zone before reaching H, the construction of the fire brick lining is made as shown in Fig. 1, a contracted neck G being made just below the upper zone.

With this construction it was supposed that the resistance to the passage of the gas through the neck filled with peat coke would be great enough to prevent the gas from being drawn down through the coke to the off-takes—instead of through the chamber B and pipes C and V, Figs. 1 and 3, and chamber K, and then up through the incandescent carbon to the two gas



Side Elevation.
Fig. 3.—Korting Peat Gas Producer.

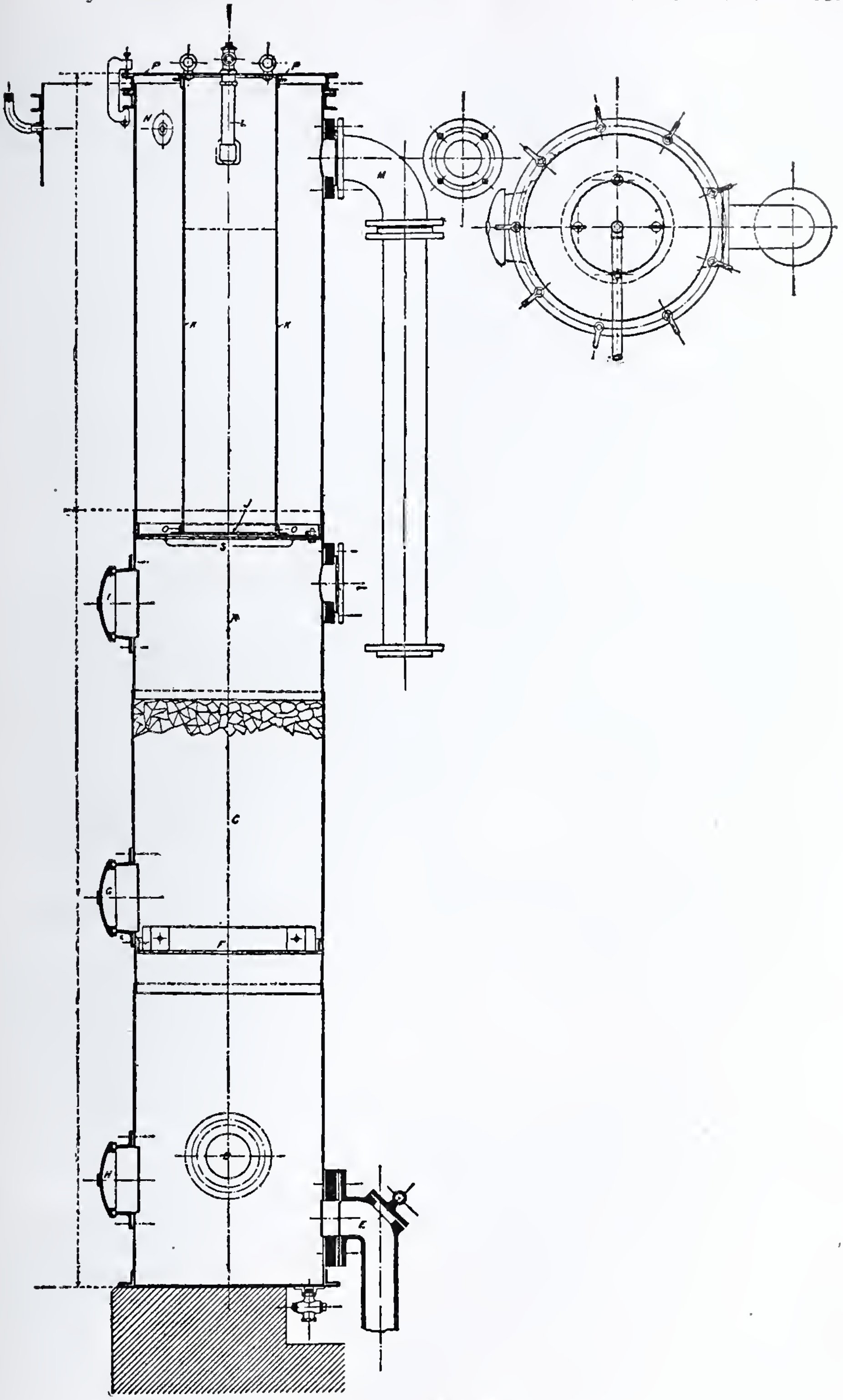


Figure 4. Korting Improved Wet Coke Scrubber.

off-takes H-H. This construction, however, did not prove entirely satisfactory, since a portion of the gases evolved in the upper zone passed directly down through the contracted neck to the off-takes, and consequently left the producer with the original moisture and tarry matter driven off in the upper zone.

To overcome this difficulty the construction of the producer was changed—this alteration will be described later.

The combustion taking place at the upper zone should be just sufficient to supply the heat necessary to evaporate the moisture and drive off the volatile matter contained in the peat. The gaseous products, viz., water vapor, tarry vapors, carbon monoxide, carbon dioxide, and a small percentage of gaseous hydrocarbons, in the form of stable gases, resulting from the combustion taking place in the upper zone, are drawn off, as explained previously, through the chamber B (Fig. 1), and down through the water-cooled pipe V (Fig. 3), to the gas chamber K, situated under the fires of the lower zone. Some of the tarry vapors, and probably some moisture are condensed on the water-cooled surface of pipe V and drop to the bottom of the water seal W (Fig. 3): from which the tar can be readily removed. That portion of the moisture and tarry vapors which escapes condensation in passing down through the water-cooled pipe V, is drawn up through the incandescent peat-coke of the lower zone, and through the gas off-takes.

A part of the moisture is decomposed by reaction with the hot carbon, forming free hydrogen carbon monoxide and carbon dioxide. Part of the carbon dioxide is reduced to carbon monoxide, and some of the tarry vapors are decomposed—forming permanent combustible gases.

The following analysis shows the composition of a sample taken from the gases evolved in the upper zone:

CO_2	15.3 per cent by volume
CO	7.2 per cent by volume
O_2	3.2 per cent by volume
C_2H_4	0.7 per cent by volume

The residue being chiefly nitrogen, the gases would also contain water and hydrocarbon vapors, which would condense in the sample bottle before analysis.

The successful operation of this producer depends, as previously stated, on the quality of the fuel fed to the lower zone and the passage of the bases evolved at the upper zone through the bed of incandescent peat coke of the lower zone before leaving the producer. Partially coked peat on the one hand, and the passage of the upper zone gases down through the fuel to the off-takes, on the other hand, or both of these together, will

result in a final gas heavily charged with tarry matter; since any volatile matter contained in the fuel fed to the lower zone cannot possibly be destroyed or cracked, inasmuch as this volatile matter will be distilled by the heat of the lower zone and pass off without reacting with the hot carbon, or burning. The same condition prevails with regard to the passage of the gases and tarry vapors evolved at the upper zone down through the contracted neck and fuel to the off-takes; since these gases, moisture, and tarry vapors do not come into contact with the hot carbon, hence leave the producer practically unchanged.

With the producer as originally constructed, as shown in section on Fig. 1, both these conditions prevailed to a certain extent, with the result that the cleaning system failed to separate the tar from the gas, consequently the valves and piston of the engine, in a short time, became clogged—necessitating cleaning.

Alterations to Korting Producer.

After considerable experimentation to overcome this difficulty—all of which proved futile, I made certain suggestions to the Canadian representatives of the Körting Brothers regarding modifications to the producer, the adoption of which, in my opinion, would greatly improve its operation. As a result of these suggestions the Körting Brothers experimented with several tons of peat sent from the Government bog, and finally altered the shape of the lining and made other changes which will be described later. The alterations to the producer are shown on Plate 2.

The principal change in the design is the lengthening of the contracted neck, which ensures greater resistance to the passage of the gases down through the fuel bed. The grates of the upper zone were made with greater air spaces, while those of the lower zone were so designed that the gases passing through the hot fuel of this zone would be deflected towards the off-takes.

These changes tended to greatly improve the operation of the producer; but the gases delivered to the engine still contained so much tar that the piston and cylinder soon became covered with a deposit of tar, which had to be removed.

The grates of the lower zone—after the producer had been in operation some time—became clogged with ashes and clinkers over the openings admitting the upper zone gases, and this upset the operation, forcing the gases to pass directly down through the narrow neck and fuel to the gas off-takes. The construction of these grates covering the gas chamber, previously mentioned, made it impossible to clear this portion of the grates while the plant was in operation—hence such grates are

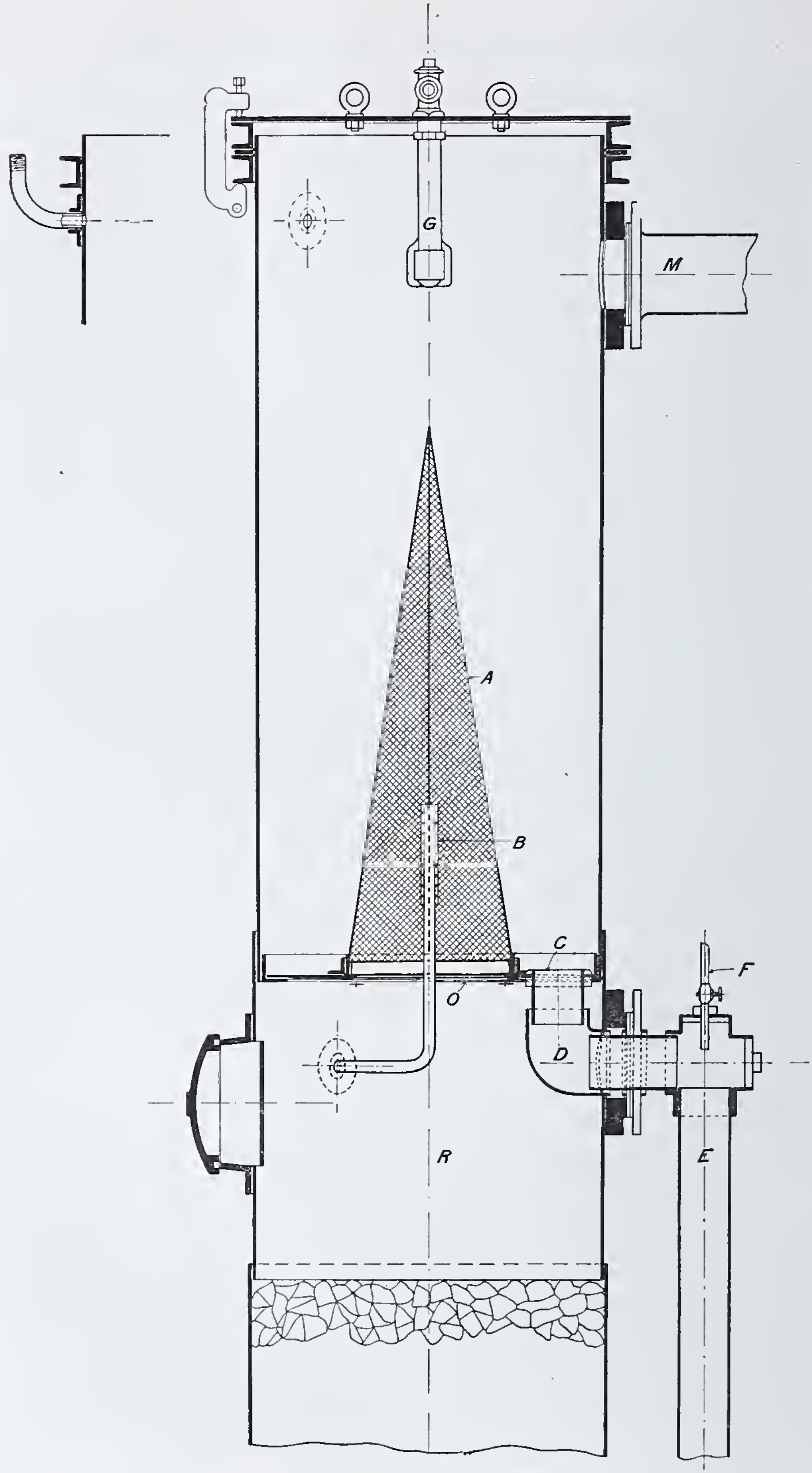


Fig. 6.—Newly devised tar separator.

impracticable. The grates used with the producer, as formerly constructed, were made with larger and more simple openings, which permitted ashes to fall through easily into the gas chamber, thus preventing clogging. These grates were substituted for the newly designed ones, and proved more efficient in every respect.

Gas-cleaning System.

The gas-cleaning system consists of a wet coke scrubber, tar filter, and dry scrubber. The wet coke scrubber with the improvements incorporated at the time the producer was altered, is shown in Fig. 4. The cleaning system is shown in section in Fig. 5, as it was originally constructed, with the exception of the tar filter, which was added as an extra precaution against tar entering the engine.

On Fig. 4 the addition to the original scrubber is designated by B, and consists of a cylinder about five feet long, rivetted to the top of the old scrubber, which is designated by A. The cap P-P, is fastened to the top of this cylinder by clamps. Inside this cylinder there is placed another cylinder of smaller diameter (K-K) which fits firmly between the cover-plate P-P and the diaphragm O-O. This cylinder is perforated with small holes about two-thirds of its height. The lower end rests on a perforated plate J. The gas is cooled by the water spray L, which also washes off matter sticking to the inside of the cylinder.

The lower portion of the scrubber A is filled with coke as shown at C.

Tar Filter.

This filter is composed of a number of staggered baffle plates around which the gases pass before passing finally through four perforated metal plates. The baffle and perforated plates are washed by sprays of hot water. The hot water for spraying is obtained from the return cooling water of the gas engine.

Dry Scrubber.

From the tar filter the gas passes through a dry scrubber which consists of a closed cylinder filled with wood fibre.

The Gas-Cleaning System of the Plant Presented the Following Disadvantages.

(1) The gas-cleaning system, while removing a considerable amount of matter from the gas, failed to remove the tar which caused the trouble at the engine. The gas carried past the entire system a considerable quantity of a liquid tar in the form of vapor, which condensed on the valves, cylinder and piston rings of the engine, causing them to stick.

(2) A considerable amount of light tarry matter of a yellow color was deposited in the off-takes M, Fig. 4, which after a few hours of running filled the orifice of this off-take to such an extent that the suction was very greatly increased.

(3) Some of the tarry matter adhering to the outside of the inside cylinder K-K, was washed off, and dropped to the bottom of this portion of the scrubber, between the enclosing and enclosed cylinders. When the gas was very dirty this accumulation was considerable, and had to be removed after a few days' operation.

(4) The baffle-plates of the tar filter became in a short time so choked with matter passing the wet scrubber, that the engine operated with difficulty on account of the high suction.

(5) While the increase in suction on the gas main due to these causes did not often necessitate the shutting down of the engine when the engine was once started—the greatest difficulty was experienced in starting on a cold system.

Under the circumstances above enumerated, the plant could hardly be called practical or commercial in any sense, since the amount of time and labor involved in cleaning the different parts of the system was excessive. To overcome these difficulties and, if possible, render the plant entirely commercial and practical in every respect, considerable time was devoted to investigation of the nature of the tarry products carried by the gas leaving the producer, and experimentation with different devices for removing them. As a result of this work, the writer devised a modification to the wet coke scrubber and tar filter which proved successful in removing the deleterious matter from the gas—and this economy was achieved without increasing the suction on the engine.

Modification to Wet Coke Scrubber and Tar Filter.

The modification devised by the writer to the wet coke scrubber is shown in Fig. 6—and consists of a fine mesh screen cone which takes the place of the perforated cylinder previously described. The cold water spray L, now washes off the matter deposited on the outside of the cone to the bottom, whence it leaves by the overflow provided for this purpose. Inside the cone is placed an additional spray provided with hot and cold water connections. In practice it has not been found necessary to use the hot water on this spray—it was provided for the purpose of reducing excessive suctions which might arise through the clogging of the fine meshes of the screen.

The tar filter was altered by removing the baffle plates and four perforated plates, and introducing in their place, four screens varying from coarse mesh at the gas inlet end to very

fine mash at the gas outlet end. These screens were so constructed that they could be easily taken out by removing the cover-plate of the filter. A spray, provided with both hot and cold water connections, is placed over each of these screens. This method of cleaning the screens has proved to be very efficient and the hot water connection can be dispensed with, while running.

Advantages of Improved Cleaning System.

The improved cleaning system possesses the following advantages:

(1) The wet coke scrubber completely clears itself of any matter, thus reducing the suction at this point to a minimum, and retaining it throughout a run of a period of considerable duration.

(2) The larger portion of the heavier tarry matter is separated from the gas in this scrubber.

(3) The tar filter separates out the more liquid or lighter tars, and does not clog. The suction at this point is very low, and does not vary to any extent throughout a run of almost any duration.

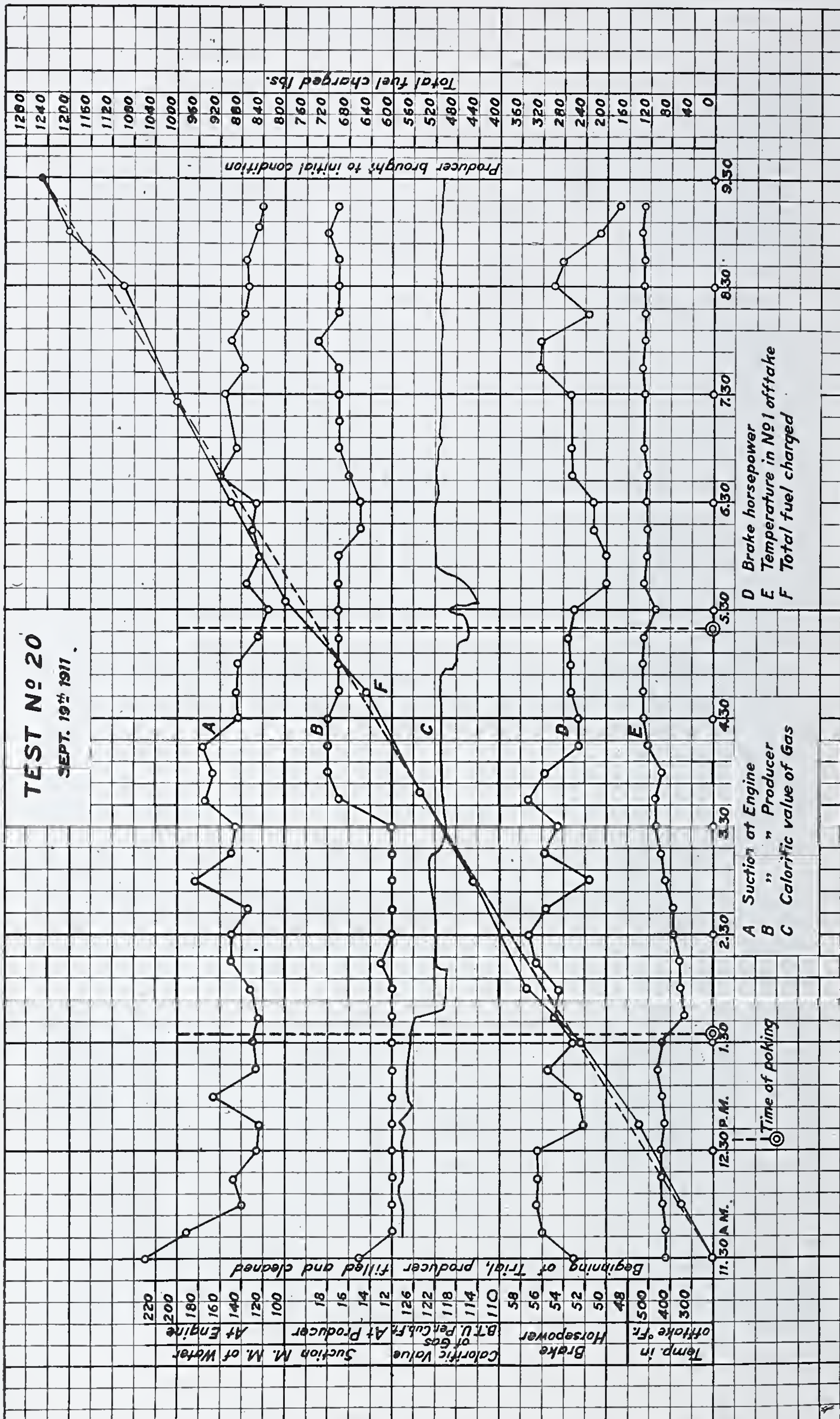
(4) By means of these modifications the total suction on the gas main leading to the engine has been reduced from 6 or 7 inches, and more to about 3 inches, with the resulting greater efficiency in cleaning the gas.

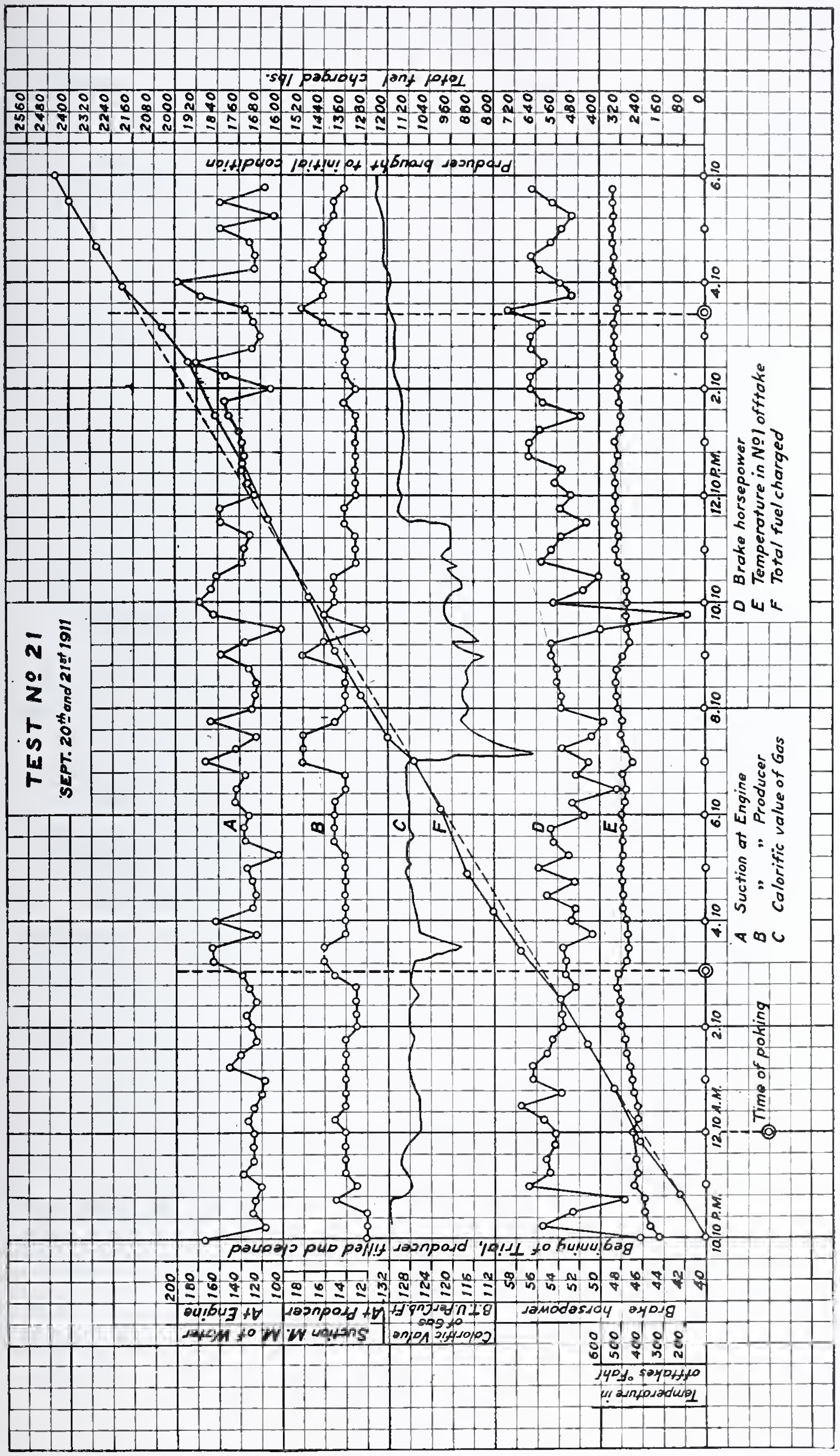
As the plant is at present constructed and operated, very little tarry matter is carried past the producer, hence but comparatively little material, possessing high heating value, is lost in the cleaning system.

The engine can be operated at any load up to maximum for a long period, either continuously or intermittently, without the necessity of cleaning valves or piston. Previously, it was found necessary to wash the piston several times a day with a mixture of oil-soap and water; and although this method of cleaning the cylinder and piston of tarry matter proved reliable and efficient, the operation was always more or less dirty. The tar distilled from peat at the temperatures prevailing in the producer is soluble in a mixture of oil-soap and water; and since no harm results from employing this method of cleaning while the engine is in operation, the plant, strictly speaking, was commercial, even under these adverse conditions.

Results of Tests.

The following summary of the results of a 20 and 10-hour test at a load of about 53 B. H. P. made with the 60 B. H. P. Korting producer-gas power plant at the Fuel Testing Station, Ottawa, and the Chart No. 1, which shows the results of the


TEST No 20
SEPT. 19th 1911.
A Suction at Engine
B " Producer
C Calorific value of Gas
D Brake horsepower
E Temperature in No 1 offtake
F Total fuel charged
Time of poking
Total fuel charged lbs.
Producer brought to initial condition
Beginning of Trial, producer filled and cleaned
Suction M. M. of Water At Engine
At Producer
Calorific Value of Gas B.T.U. Per Cub. Ft.
Brake Horsepower
Temp. in offtake °Fr.
11.30 A.M.
12.30 P.M.
1.30
2.30
3.30
4.30
5.30
6.30
7.30
8.30
9.30


TEST No. 21
SEPT. 20th and 21st 1911
A Suction at Engine
B " " Producer
C Calorific value of Gas
D Brake horsepower
E Temperature in No. 1 offtake
F Total fuel charged
Time of poking
Total fuel charged lbs.
Producer brought to initial condition
Beginning of Trial, producer filled and cleaned
Suction M.M. of Water At Engine
At Producer
Calorific Value of Gas B.T.U. Per Cu. Ft.
Brake horsepower
Temperature in offtakes °Fahr
10.10 P.M.
12.10 A.M.
2.10
4.10
6.10
8.10
10.10
12.10 P.M.
2.10
4.10
6.10

20-hour test, graphically are self-explanatory and require but few comments.

Trials with Alfred Peat, Air opening for Full Load on Gauge.

1. No. of trial,	20		
2. Date of trial,	Sept. 19	Sept. 20 and 21	1911
3. Time of starting,	11:30 a.m.	10:10 a.m.	
4. Time of stopping,	9:30 p.m.	6:10 a.m.	
5. Duration,	10	20	hrs.
6. Total peat charged during trial,	1250	2450	lbs.
7. Total ash and clinker drawn during trial,	60	116	lbs.
8. Total peat used for banking and starting,		431	lbs.
9. Total peat used during trial and for banking and starting,		2881	lbs.

Particulars of Peat Used—

10. Moisture % in peat as charged,	31.4	30.2	

Proximate Analysis of Dried Peat as Charged—

11. Fixed carbon,	29.5	30.0	%
12. Volatile matter,	64.8	64.6	%
13. Ash,	5.7	5.4	%
14. Calorific value of dry peat,	9470	9450	%
14. Calorific value of dry peat,	9470	9450	B.T.U.
15. Calorific value of peat as charged,	6500	6600	per lb.
16. Combustible matter in refuse,	53.4	29.7	%
17. Barometer reading,	29.85	29.88	inches
18. Wet bulb (in producer room),		59.2	F
19. Dry bulb,		67.1	F
20. Humidity,		64.8	%
21. Average suction at producer,	.6	.5	in. of water
22. Average suction after coke scrubber,	4.3	2.6	
23. Average suction after tar filter,	4.7	4.7	in. of water
24. Average suction after dry scrubber,	5.7	5.4	in. of water
25. Temperature of gas leaving producer in No. 1 exit,	469	475	F

Engine and Generator—

26. Average revolutions per minute of engine,	190	190	
27. Temperature of outlet cooling water,	111	115	F
28. Average kilowatts delivered to switchboard,	35.3	35.2	
29. Average electrical horsepower,	47.3	47.2	
30 Efficiency of dynamo,	.88	.88	
31. Average brake horsepower of engine,	53.8	53.7	

Gas Analysis Per Cent by Volume—

	10 samples	20 samples	
Sample taken after passing tar filter.			
32. Carbon dioxide,	10.8	9.9	%
33. Ethylene,	.5	.4	%
34. Oxygen,	.5	.3	%
35. Carbon monoxide,	17.7	20.2	%
36. Methane,	2.4	2.4	%
37. Hydrogen,	10.2	10.3	%
38. Nitrogen,	57.9	56.5	%
39. Inflammable gas,	30.8	33.3	%
40. Calorific value from analysis (Gross),	122	128	
41. Calorific value from analysis (Net),	113	120	B.T.U. per cu. ft.
42. Average net calorific value from recording gas calorimeter,	123	127	

Results of Tests—

43. Total peat charged during trial,	1250	2450	lbs.
44. Total dry peat charged during trial,	858	1710	lbs.
45. Total ash and clinker drawn during trial,	60	116	lbs.
46. Ash and clinker drawn per cent of peat charged,	4.8	4.7	
47. Ash and clinker drawn per cent of dry peat charged,	7.0	6.8	
48. Average kilowatts delivered to switchboard,	35.3	35.2	
49. Average brake horsepower of engine,	53.8	53.7	

Hourly Quantities—			
50. Lbs. of peat charged,	125	122	
51. Lbs. of dry peat charged,	86	86	
Economic Results—			
52. Peat charged per K. W. hour,	3.54	3.47	lbs.
53. Dry peat charged per K. W. hour,	2.44	2.44	lbs.
54. Peat charged per B. H. P. hour,	2.32	2.27	lbs.
55. Dry peat charged per B.H.P. hour,	1.6	1.6	lbs.
56. Overall thermal efficiency of engine and producer,	16.8	16.9	%
Results Deduced from Fuel and Gas Analyses—			
57. Air supplied to producer per lb. of dried peat charged,	39.2	37.6	cu. ft.
58. Water supplied to producer per lb. of dried peat charged,	.47	.46	lbs.
59. Cubic ft. of gas produced per lb. of dried peat charged,	53.4	52.6	
60. Heat equivalent of gas produced per lb. of dried peat charged,	6040	6310	B.T.U.
61. Producer efficiency,	63.8	66.8	%
62. Cubic ft. of gas delivered to engine per hour,	4590	4520	
63. Cubic ft. of gas delivered per B. H. P. per hour,	85	84	
64. Heat equivalent of gas delivered per B. H. P. per hour,	9660	10100	B.T.U.
65. Thermal efficiency of engine (B. H. P. basis),	26.3	25.2	%

The gas-cleaning system used during these tests was not yet perfected and, although the gas delivered to the engine was sufficiently clean, the fluctuations in suction at the wet coke scrubber were quite noticeable. The tar filter, moreover, had not yet been altered and some considerable fluctuation was observed due to clogging of this portion of the cleaning system.

Since altering both the wet coke scrubber and tar filter a

noticeable reduction in the total suction has been observed. This suction does not vary more than a few centimeters during a 10-hour run, and no trouble is experienced when starting up on a cold system. Since the tests above quoted were made, the screen cone in the wet coke scrubber has been replaced by one of coarser mesh, which, in conjunction with the screens in the tar filter, has proved entirely efficient and satisfactory both as regards the resistance set up in the system due to these screens and the cleanliness of the gas.

The total suction on the engine main varies but little from three inches, and often falls below this amount.

Quality of the Gas: The chemical composition and calorific value of the gas is only slightly altered as a result of cleaning the fires. When one side is poked at a time this variation is reduced to a minimum, which is not of sufficient amount to necessitate resetting of the air and gas valves of the engines.

Operation of the Producer: The operation of the producer as it is now designed and with the grates of larger openings over the gas chamber K Fig. 1, substituted for those of newer design, is very uniform. The feeding of the fuel from the upper zone proceeds regularly and evenly, and the peat fed to the lower zone appears to be thoroughly coked. The producer can be operated for several hours without poking or cleaning the fires, and since this operation, as well as that of removing the ashes, can be performed while the plant is in operation, the producer is capable, in every respect, of continuous operation.

Cleaning of the Producer Gas Mains, etc. The gas pipe leading the gases evolved at the upper zone to the lower zone should be cleaned once a week—owing to the accumulation of tar in the damper chambers while the producer is standing idle. The accumulation, mostly pitch, in the two gas off-takes is of small amount during a week's run—but to insure the proper operation of the producer, these pipes should be cleaned about once a month.

Reliabilty: The peat producer-gas power plant, as now constructed, may be pronounced as thoroughly reliable. Its operation may be carried on continuously for a week or more without having to shut down for the purpose of cleaning the valves of the engine. The engine has been operated for a period of 150 hours without removing either the admission or mixing valves for cleaning, and it should not be found necessary to remove the piston, in commercial practice, more than once in six months for purposes of cleaning.

Attendance: A peat producer-gas power plant of the capacity installed in the Fuel Testing Station can safely be left in the hands of an intelligent laborer after he has received in-

structions in the handling of the plant for a week or so, from a competent engineer. The services of only one man is required to run such a plant when it is operated on day shift work only.

Fuel Consumption: The consumption of fuel per Brake Horsepower hour, including stand-by losses, is for full load 1.7 lbs. of dry peat, or 2.3 lbs. of peat containing 25% moisture; for ¾ load, the consumption, including stand-by losses, is 2.1 lbs. of dry peat, or 2.8 lbs. of peat containing 25% moisture. The fuel consumed while the producer stands idle has been determined for a period extending over several months. The average consumption has been found to be between 2 and 3 lbs. per hour when the producer stands over night, i. e., for 14 hours; and between 1 and 2 lbs. per hour for longer periods, i. e., three days or more.

Cooling Water: The amount of water used for cooling and cleaning the gas is normal.

Cost of Fuel.

In estimating fuel costs, the assumption is made that peat, with a moisture content of 25%, can be delivered to the producer for $2.00 per ton. In order, however, to take advantage of this, or a lower cost for fuel, the power plant must be situated at or near the bog where the peat fuel is manufactured. For small plants of the type and capacity described, this might not prove feasible in many cases—but will prove entirely feasible and practicable when the plants erected are of large capacity, and when the energy generated is transmitted in the form of electricity to neighboring towns and villages, for lighting, power and other purposes.

Since the fuel burned in the producer does not require to be of the best quality, the fuel cost may be considerably reduced; since the broken peat bricks, and considerable fines, which always occur in the manufacture of peat, and which otherwise would represent a loss, can be efficiently utilized in the producer. Assuming, however, that peat can be delivered to the plant for $2.00 per ton, and that the plant is running with a power factor of 75% for 3,000 hours, the fuel costs would be $8.40 per B. H. P. year, including stand-by losses.

REPORT OF THE ANNUAL MEETING,

New York, Sept. 5th, 6th and 7th, 1912.

The Sixth Annual Meeting of the American Peat Society took place in New York City, at Columbia University, on September 5th, 6th and 7th, 1912, concurrently with the Eighth International Congress of Applied Chemistry.

From a scientific as well as a practical view, the meeting was a great success. The educational work of the Society cannot fail to be furthered by such a meeting. Both in industrial and agricultural lines were reported great activity. Many peat plants and truck farms are being contemplated.

Dr. J. A. Holmes, Director of U. S. Bureau of Mines, gave a valuable address on the methods of reducing fuel wastes and of using low grade fuels, especially peat, in the parts of the country where other fuel has to be imported. He complimented the work accomplished by the Canadian Government, and saw the wide possibilities of adopting the results to many of middle and far western farming centers. The work of the Bureau of Mines to further these ends was outlined.

Dr. J. H. Pratt, State Geologist of North Carolina, showed the great work done in his state, by which gradually all available swamps will be recovered to agricultural or to industrial purposes. By long period state bonds the owners of swamp lands pay very little per year for the great improvements, but in time the work pays by itself. Dr. Pratt will be glad to send maps of swamp lands to any member.

"Agricultural Value of Peat Lands" was a paper by Prof. W. R. Beattie, recently of the U. S. Department of Agriculture, in which he showed the great value of peat bogs for agriculture. This will be published in full.

"Peat Fuel and Methods of Its Preparation" was a highly interesting paper by Dr. T. Arthur Mighill, of Boston. How to prepare and gather peat for fuel on a large scale, and the peat machinery to be used, was fully described, and discussed by many members. This paper will appear in full.

Mr. B. F. Haanel, Canadian Department of Mines, gave a vivid description of the great work done by the Canadian Government, especially at the Government peat gas-producer plant, which has been in operation for over two years, and showed that the use of peat fuel in the gas producer was entirely commercial. This important paper forms, in its entirety, one of the most notable contributions to peat literature in the power line.

Mr. Ernest V. Moore, B. S., read a paper on the Alfred, Ont., plant, which was bought from the Canadian Government. It is now successfully operated by improved methods and machinery.

Mr. James E. Smith, of Clinton, Iowa, exhibited numerous samples of substances manufactured from peat. Several grades of the dried peats were treated and sold for cattle food or poultry food. To some of the products of distillation he attributed various valuable qualities.

Professor Charles A. Davis reviewed the progress of peat utilization in 1911, both in America and Europe. Progress was reported in methods of handling peat by machinery on a large scale and its commercial use as fuel. The great advances had been made in Europe, though some promising machinery had been developed in America.

The Secretary's Financial Report of the Society for the past year was as follows:

Receipts.

Amt. of dues from 101 members	$502.00	
Extra copies of Journal	22.00	
Advertising	15.00	
Contribution of J. N. Hoff	20.00	
	$549.00	
July 1st, 1911, balance on hand	145.78	
		$694.78

Disbursements.

Printing of April, 1911, Journal	$ 92.00		
Printing of July, 1911, Journal	90.00		
Printing of Oct.-Jan., 1911, Journal	154.27		
		$336.27	
Stationery		107.54	
Postage		100.97	
Typing		48.04	
Expressage		6.72	
Sundries		21.75	
		$621.29	
Julst 1st, 1912, balance on hand		73.49	
			$694.78

Respectfully submitted,

Julius Bordollo, Sec.-Treas.

Audited and approved—

C. F. McKenna,

Herbert Philipp,

G. Herbert Condict.

On Friday, September 6th, seventeen members visited and inspected a complete peat fertilizer filler plant at Alphano, N. J. The extracting of the peat from the bog, gathering it into steel cars, transporting the material direct to the dryers, where from 100 to 150 tons of finished product are made per day of 24 hours. The dried peat is automatically loaded to the railroad cars for shipment.

In cultivated areas adjacent to the plant there were several hundred acres planted with celery and onions, a most beautiful sight. It gave the visitors an object lesson by showing how industrial development can be successfully combined with agriculture.

Upon Dr. Pratt's motion, a resolution was passed asking Congress for an extra appropriation for securing more quickly mapping of swamp lands in the Eastern States, that a united action may be inaugurated for improving all swamp lands. The resolution was as follows and was passed unanimously.

"Whereas, the drainage of the swamp lands of the United States is one of the more important of the economic problems that now is before this country; and

Whereas, the drainage of such swamp lands will add very materially to the public health and bring under cultivation some of the richest lands of the country, and thus increase the wealth and prosperity of the States; and

Whereas, a topographic map of these areas would be of very great and material assistance in connection with the engineering problems in regard to draining these swamps, and a soil survey would determine the agricultural value of these swamp lands; and

Whereas, the Congress of the United States is already making annual appropriations for the preparation of a topographic map and a soil survey of the United States;

Be it resolved, That the American Peat Society memorializes the Congress of the United States to make a sufficient additional appropriation to the topographic division of the United States Geological Survey to enable it to prepare as rapidly as possible a topographic map of the swamp areas of this country, and that a sufficient appropriation be made to the Bureau of Soils of the Department of Agriculture which will enable it to prepare at once a soil survey of these swamp lands."

A eulogistic obituary extract was read regarding our former member, Mr. F. G. Mayer. It was moved and adopted that the following letter be sent to his family:

"The American Peat Society is grieved to learn at this its Sixth Annual Meeting of the death of Frederick J. Mayer.

Mr. Mayer, though joining our ranks but a few months ago, was long previously known to many of us as a learned engineer and conscientous man of affairs. As his greatest life work was devoted to the conservation of fuel and he early gave his encouragement to the movement for which our Society has been striving, he expressed his firm belief in it and later became a member with us. Mr. Mayer will long be missed both in the field of accomplishment, where he was admired for robust honesty and always honorable conduct, as well as in the quieter walks of social life, where his frankness and cordiality and his ever present kindness lent a peculiar charm to his company.

The Society sends its heartfelt condolence to his bereaved widow."

The Annual Meeting terminated with an informal banquet at the Hotel Chelsea, which was well attended and thoroughly enjoyed, as the menu shows:

MENU.

Now Peaters, dig away! It's 90 per cent water!
Moor Cocktail

RELISHES—TURF FROM SAXONIA FARM

DEHYDRATED Sweet Relish DREDGED Olives
Sliced Cucumbers a la MUD

BY-PRODUCT Soup

Cream of HACKENSACK Corn, MEADOW Style

"SUN DRIED" Spanish Mackeral, ALPHANO Style
Minced Marsh Hen a la KLEINSTUECK
CANADIAN Rack Spring Lamb, PEAT MULL SAUCE
DRAINED Green Peas BOG Potatoes
MASCERATED Salad, LITTER Style

MUCK Coffee PUMPERNICKEL BRIQUETTES

FERTILIZER "SELF PROPELLED" Cheese
"AIRED DRIED". Crackers
PRODUCER GAS Demi Tasse a la MOND
And then the Re-PEATERS
HOT AIR Toasts

IS PEAT AN IMPORTANT FUEL IN THE UNITED STATES ?

Charles A. Davis.

(By permission of the Director of the Bureau of Mines.)
(Read at the New York Meeting, April, 1912.)

The title of this paper suggests to the reader a negative answer but on reflection it is evident, in a general discussion, that definition of the terms employed is an essential to clear understanding of the subject matter presented. It is, therefore, pertinent to inquire into the word "important" in the title and clear up, as used there, its significance, so that there will be no misunderstanding of its meaning.

If the question is asked for the entire country and for the immediate present, only a negative answer can be given by even the most optimistic.

On the other hand, one has but to glance at a map showing the distribution of the regions of abundant workable peat deposits in the United States to see that they lie almost entirely outside of the coal fields of the country. Moreover, they are found in districts where much fuel is required and where fuel of every kind is constantly growing dearer as economic conditions change, and demands on the diminishing supplies of wood, coal, and other fuel supplies become more insistent, and transportation and handling charges become higher.

The total area of peat beds in this region, which have sufficient size, depth and purity to be attractive for commercial exploitation, has been conservatively estimated at approximately 11,200 square miles; these beds, in round numbers, probably contain at least 13 billion tons of salable fuel. There is probably an equal, or greater, area of small peat deposits, with, at the least estimate, an equal possible tonnage, which could be worked for fuel by individuals, or small communities, but might not be attractive for larger investors.

This estimated tonnage would supply the entire country with fuel for many years if used at a rate equivalent to the present rate of coal production. If used only in the parts of the country where it occurs, it is obvious the use-life of the resources would be much prolonged, as well as that of the fuels which would be displaced.

When properly prepared and used in correctly designed fire boxes, peat is a fairly good fuel, the best grades, on the theoretically dry basis, exceeding in thermal value many lignites and some of the poorer grades of coal. The best peats may run as high as 11,000 B. t. u. per pound, but those giving

from 8,000 to 9,000 B. t. u. are much more common, just as medium grade coals are more common than those of highest calorific value.

Although peat has been used as domestic fuel in Europe for many years, and there has been a marked increase in its use for power production in Sweden, Russia and Germany during the past decade, it has never been produced on what could be termed a commercial basis in the United States. For this reason it has frequently been said by American writers that other and better types of fuel were so abundant and cheap in this country that there was no place for peat, when, as a matter of fact, in at least some of those parts of the United States where peat is of frequent occurrence, coal sells at considerably higher prices than good English coal can be had in some of the peat-consuming countries of Europe.

Such writers also point out that, in spite of the large sums of money spent in establishing peat-fuel factories in the United States, no peat fuel has been put on the market, and say that, therefore, peat fuel is a failure here. As a matter of fact, however, a careful analysis of the attempted manufacture of peat fuel in the United States shows that other causes than qualities inherent in the peat, have been operative to prevent the success of the factories mentioned, and that every pound of the fuel which they have made could have been, or has been, sold; in fact much more has been called for than could be delivered. The causes of failure have been such as beset all new and untried industries, and most of them could be directly traced to the inexperience, the optimism, and, too often, to the ignorance of those having the developments in charge. The experience of European experimenters and manufacturers has been passed lightly by, as not applicable to our conditions, or often has been entirely ignored, and untried machines and processes substituted for those of proved worth. Not infrequently, purely visionary plans and machinery, based on entirely wrong conceptions of the properties of peat, have been made the basis of the enthusiastic promotion and construction of costly plants, which, from their inception, never had a chance to successfully produce peat fuel on a commercial scale.

The greatest practical difficulty in preparing peat for fuel lies in its high water content, which may exceed 90 per cent, as it lies in the bog, and rarely, even in drained bogs, is lower than 80 per cent. After trying and abandoning many devices for pressing the water from peat, for treating it by heat, both directly and by superheated steam, and by electricity to remove the excess of water, European peat fuel producers

have now come to rely almost wholly upon the sun's heat for drying their product. The raw peat, wet as it comes from the bog, is thoroughly pulped or ground in simple machines and either formed into bricks, which are removed from the machine and laid out to dry on pallets or, by the most recent practice, the macerated, wet peat is spread by the use of a simple mechanical spreading device, into a thin sheet on the roughly prepared surface of the bog, as near as possible to the excavating pits. The same machine which spreads the pulp, also cuts it up into brick-shaped pieces, which, when dry enough, are turned by hand and, still later are piled up in small open piles; when they have dried sufficiently, they are stacked under sheds, or in loosely piled stacks, to complete the drying process.

It has generally been assumed by American experimenters that such a method of procedure was not adapted to labor conditions existing in the United States. Hence, no serious attempt has been made in the country to establish a peat fuel factory of this kind to learn if it could be made profitable here. In Canada, however, the Mines Branch of the Dominion Department of Mines, after careful preliminary investigation, established, in 1909, a peat fuel plant for demonstration purposes. It was equipped with machinery that had been thoroughly tested by continued commercial success, imported from Sweden, and the entire operation of the plant was placed in charge of a well-trained and experienced man. The work at this factory was carried on by laborers hired in the neighborhood of the plant, who were paid about the same wages that would be paid in the United States for similar work. The capacity of the plant was rated at 30 tons per day of salable product. The output for the first, short, season's run was given as 1,600 tons and the average cost of production based on this, and all charges included, according to official figures, was $1.65 per ton, loaded on the cars, of which only about $1.00 was for actual production. This price, it is stated, could be reduced by the use of mechanical diggers, already perfected, in place of hand digging, which was used.

Peat fuel made by this method has a calorific value considerably greater than half that of good bituminous coal and is a more acceptable fuel than coal to many people for cooking and other domestic purposes and in properly constructed fire question, by experiments by the U. S. Geological Survey, by the Canadian authorities that the equivalent in peat fuel, of a ton of anthracite, costing in Ottawa $7.50, could be made ready for use for less than $3.00.

As to the possible use of peat fuel of this type, for power

generation; it is an old story that several industries, notably cotton factories, in Russia, for years have been using peat fuel for generating steam; it is also reported that this use increases at the rate of about 200,000 tons a year. In Germany and Sweden, also, there is a growing use of this fuel for power production, kiln firing, and foundry work.

The most recent advances in utilizing peat for fuel, however, have been made by its use in the gas producer for generating power and fuel gas. It has been established beyond question, by experiments by the U. S. Geological Survey, by the Canadian Department of Mines, and by successful commercially-operated plants in Sweden, Germany and other countries of Europe, that air-dried peat is a good fuel for gas production. In some makes of producers, designed for the purpose, peat is now gasified and made to furnish a clean and uniform gas, of good calorific value, to gas engines, and electric lighting and power plants are known in which no other fuel than peat has been used for several years past.

A recent report of one investigator, who has had exceptional opportunities for working on the subject, states that with the type of gas producer with which he has worked, he gets a producer gas which enters the engine entirely free from tar and other bituminous matter, and that the producer required no poking, or other attention, except when fuel is added and the ash removed, so that one man can attend to both the producer and engine. The average result of test runs with this producer was a horse power per hour for somewhat less than 2 pounds of dry peat fired, which is in close accord with results obtained elsewhere. The author of this report also states that he feels justified in estimating that, if peat fuel can be delivered at the producer for $2.00 per ton, the cost of a horse power per year, in plants equipped with gas producers and using peat fuel, should be about $7.50.

As $2.00 per ton is a very conservative estimate for the production and delivery of air-dried peat, especially if the power plant is located near the bog, it is more than probable that the figure given may be diminished, rather than increased, in the near future.

The commercial recovery of useful chemical compounds from the products of the gasification of fuels has been so successful, that it is not remarkable, when it was found that carbonized peat was in demand, but could not be made at a profit, unless the gaseous products of the distillation were utilized, as they had been already in the making of wood charcoal, practically the same processes of recovery and purification

should be used in making peat coke as for wood carbonization, and about the same series of compounds obtained.

Furthermore, when it was ascertained that in many peats, the percentage of combined nitrogen exceeded that of other fuels, the matter of recovering this indispensable substance was taken up in earnest and made the subject of thorough study, especially along the lines worked out by Mond, in connection with the generation of producer gas from coal. Announcements have been made within the past year that this matter has been worked out so satisfactorily that three large electric power plants in different European countries are now being successfully operated by gas-producers, using peat as fuel, and recovering from the producer gas, ammonia in the form of sulphate, in quantities sufficient to make the entire operation very profitable; other plants of the same, or similar types, are in process of development and it is not improbable that we may soon have one or more in the United States. These announcements are of greater interest to all concerned in peat utilization, because they positively state that peat containing 60, or even 70, per cent, of moisture can be utilized in the gas producers and give a satisfactory quality of producer gas. The ordinary type of double-zone gas producer for bituminous fuels may be run on peat having as much as 40, or even 45, per cent of moisture, but the consensus of opinion seems to be that better results are had when the moisture content is below 35 per cent, and the difference between this and the figures cited above is of larger significance than appears at first glance; peat can be dried quickly to 65 per cent moisture, where it might be weeks in reaching the air-dried state.

Considering farther the use of peat as a source of producer-gas, careful comparison of the thermal value of the gas derived from it, as compared with coal, based on rather meager data, shows that the peat gas has about the same, or a slightly larger, number of thermal units per cubic foot, as gas generated from coal in the same type of producer, while in ease of handling, quality of the ash, clinkering, etc., peat has the advantage. To secure the highest efficiency in scrubbing as well as in gasification, the producer in which peat is to be used should be specially designed for it, but the same is equally true of other fuels.

Peat in the form of finely ground dried powder has been used as fuel in Canada and in Sweden, and carefully conducted tests have been made in the latter country, both under Government engineers and by testing commissions appointed by manufacturers' associations.

The reports of these tests agree that good peat prepared and burned in this way was very nearly as efficient, ton for ton, as the English coal with which it was compared, 1.2 tons of the peat equaling in steam-raising efficiency a ton of coal, the cost of the peat being 17 per cent less ($2.76+.50 instead of $3.95, the cost of coal) than that of the coal required to do the same work.

In this country efforts have been made to eliminate the use of hand labor in preparing peat for use in the gas producer, or for boiler firing, and these seem now about to be crowned with success. If they are, and if peat fuel can be delivered to gas producers, or boiler plants, located on, or near, peat deposits, as has already been done in several places in Europe, at figures that seem quite within reasonable possibilities, in the opinion of the writer, peat is certain to be a fuel to be considered of importance to the parts of the United States where it is found, and indirectly to the whole country.

A CORRECTION.

On page 100 of this journal (July issue) occurs the following statement: "To obtain one ton of dry peat from raw material containing 85% water, 13,333 pounds of water must be carried away." There is evidently a mistake here, as 15% of 13,333 lbs. equals 2,000 lbs.; that is, 13,333 lbs. represents the weight of raw peat of which 85% is water and 15% is dry peat, or 2,000 lbs. The amount of water to be carried is 11,333 lbs. instead of 13,333 lbs. The use of the latter figure introduces a proportional error in the 170,000 cu. yards of air as required to carry off the water which correspondingly affects the rest of the calculations in the ratio of 13,333 to 11,333, or 15% less.

Boston, Mass., October, 1912. T. A. MIGHILL.

Peat Enterprises in England have been making slow advance during the past summer, although considerable interest was shown by enquirers for machinery for making briquettes and for moss litter plants. In the end, while there was ample evidence that the peat question was attracting widespread attention yet little was really done, although doubtless there will soon be a move in a practical way. Capitalists there are willing to invest, if a reasonable return can be secured for their money, and once the value and uses of peat can be put forcibly before them. But for the present they do not show a vital interest.

COMMERCIAL UTILIZATION OF PEAT FOR POWER PURPOSES.*

By Mr. H. V. Pegg.

The question of the utilisation of peat fuel for power purposes has received a large amount of attention from engineers for many years past. Efforts in this direction have mostly taken the shape of some form of preparation of peat fuel in order primarily to get rid of the superabundant moisture in the fuel. Very large sums of money have been spent on peat-preparing machinery with generally very inadequate results; hence it has always appeared to the author that, in order to bring the utilization of peat to a commercial level, the first consideration would be the utilization of the peat as far as possible in the condition in which it leaves the boglands without any preliminary and expensive machine treatment.

The author had the opportunity, about seven years ago, of experimenting with air-dried, hand-cut peat fired into a special form of gas-producer. With all gas-producers using bituminous fuel, the main trouble is to get rid of the tarry by-product. In this instance the gas-producer was arranged to work intermittently, there being periods of "blowing" during which the fuel in the producer was urged to incandescence, and periods of gasmaking during which the tarry by-products were passed through the incandescent fuel, where they were split up into gas. The chief difficulty experienced with this plant was the high thermal value of the gas generated, about 330 B.T.U. Owing to the high and varying percentage of hydrogen in the gas, it proved unsuitable for use in the works gas engine; and although the plant was running more or less continuously for ten days driving the whole works, very considerable trouble was experienced, not only in the engine, but also in the plant, owing to the varying moisture content of the peat, the producer plant being decidedly sensitive in regard to this latter point.

From the experience then gained it appeared evident that it would be wiser to extract the tar from the gas rather than to try to utilise the same by converting it into gas, and, further, that the producer must be comparatively non-sensitive to the amount of moisture in the peat fuel. Some two years ago the author discussed the question of the utilization of air-dried peat fuel with Mr. Hamilton Robb, of Portadown, who, having large supplies of such fuel convenient to his factory at Porta-

*A paper read at the Belfast Meeting of the Institution of Mechanical Engineers, July, 1912, and reprinted from The Colliery Guardian.

down, was strongly of opinion that it should be possible to utilize such fuel in order to generate the power required in the factory. As the result of various tests run with an experimental plant at the works of Messrs. Crossley Brothers, Openshaw, a special plant was eventually manufactured by them under their designs and patents and to the author's specification. This plant, which has been running since last September, has been so often dealt with in the daily and technical Press that there is no need for the author to dwell upon the details of the plant, but he proposes to make a few remarks in regard to the difficulties experienced.

Air-dried peat is not a very convenient fuel to fire into the producer, and as it was uncertain whether it would be possible to burn the fuel direct in the form in which it came from the boglands, provision was originally made in the plant to deal with peat fuel prepared by being reduced in size to blocks of about 5 in. cube, but it was found possible to dispense with the preliminary treatment, and the construction of the plant was thereby considerably simplified.

As regard the general running of the plant, last October it was subjected to a test run of six hour's duration with a load of 250 b.h.p., the peat consumption per b.h.p.-hour averaging 2.55 lb., the peat fuel containing 18.98 per cent of water; this was with both producers running, although the load was considerably below the total capacity of the plant. When necessary it has been found that the above load can be safely carried with either producer working singly, and the plant has run under these conditions for several days.

It will be noted that the percentage of moisture in the fuel during the above test was unusually low. This was owing to the unusually dry summer of 1911. During November and especially December last, the fuel fed to the plant was extremely wet, as the rainfall in those months was very heavy, and the fuel supply was and is entirely exposed to the weather. The plant, however, worked just as well with sodden peat as it did with the drier peat, the only difference being the amount of fuel consumed. The amount of water in this "sodden peat" varied considerably from day to day, and the exact percentage was not arrived at; as near as could be estimated it was at least 70 per cent.

The separation of the tar from the gas was the chief difficulty to be overcome; it was found far better to rely on an ample water-spray through which the gas passed rather than any form of a coke-scrubber, as the coke rapidly became clogged with tar. The main portion of the tar was thrown out into a tar sump by a centrifugal tar extractor; but unless

the gases were subjected to a thorough washing and cooling by the water-spray above referred to, it was found that a certain proportion of tar got past the extractor, collected in the gas mains and finally found its way into the gas engines. It was a matter of experiment as to the precise amount of water sprayed into the cooler which was necessary in order to insure that the tar vapor should be sufficiently condensed before reaching the centrifugal extractor, so as to enable the extractor to effect the needful separation. As now arranged, the proportion of tar in the gas after passing the extractor is small, and the engine valves do not want cleaning out more than once a week.

When first started, the plant generally, and especially the producers, required a thorough cleaning once a week; at the present date the plant can be run, if necessary, for three weeks without cleaning, though the weekly cleaning generally takes place as a matter of policy. This result has been obtained owing to the increased amount of washing water used, which now amounts to about 7 gallons per b.h.p. per hour. The proportion of tar recovered is about 5 per cent of the weight of fuel consumed, and during the initial stages of the running of the plant a certain amount of this tar was sold to tar-felt manufacturers at a price of 35s. per ton, but sales in this direction ceased owing to an, at present, ineradicable pyroligneous odor which persistently clings not only to the tar itself, but to all the various oils distilled therefrom.

Experiments have also been made with the tar in oil-burning boilers, but owing to the very high percentage of water in the tar—up to 50 per cent—and the large quantity of solid matter also present, a very large amount of preliminary treatment is necessary. For a considerable period the tar at Portadown was used mixed with coal and burnt under a Stirling boiler; the precise heating value of the tar so consumed has not, however, been ascertained. At the present time the whole factory at Portadown is run entirely on peat fuel, the consumption being about 44 tons per week, of which the producer plant takes about 22 tons. The nature of the peat varies considerably; with good black heavy peat the weekly consumption for all purposes drops as low as 35 tons; and with light top heat from the surface of the boglands the consumption rises to 54 tons. It is also interesting to note that the quality of the peat is reflected in the carrying capacity of the barges, which bring a load of 35 tons with heavy peat and 24 tons light peat. The peat is unloaded from the barges and conveyed to the producer platform and boiler house by a transporter. Clinker troubles are not often experienced, and only when burning the inferior

grade of peat, the presence of sand in the fuel causing the trouble.

The author is indebted to Mr. W. A. Mullen, manager at the factory of Messrs. Hamilton Robb, Limited, for the following figures in regard to the cost of fuel, these figures being given on June 12 last:

Cost of running factory on coal per week:

	£	s	d.
8½ tons of anthracite at 35s......	14	17	6
19 tons of steam coal at 17s......	16	3	0
	£31	0	6
Cost of running factory on peat per week:			
Say up to 50 tons of peat at 6s...	15	0	0
Weekly saving	£16	0	6

Allowing for 15s for extra labor, the net weekly saving figures out at £15 5s. 6d.

The author would here refer to the letter in **Engineering** of January 26 last, in which the general manager of the Power Gas Corporation Limited gives some very interesting particulars in regard to peat plants, more especially an ammonia recovery plant working in the south of England. It would be of great interest if some figures as to the working costs of this plant could be laid before this meeting. It will be noted that plant is worked with ammonia recovery, which would mean a very much larger plant than that at Portadown. The amount of the nitrogen in the south of England peat is apparently high, and would appear to be considerably more than in the peat used at Portadown, analysis of which is appended hereto, together with analysis of the refuse tar and gas from the producer.

Analysis of Tar Made by Messrs. Totton and Hawthorne.

Sample of Tar No. 2.

The sample was grey when received, but very quickly turned black. On distillation it yielded:

		Per cent.
1.	Water	37.2
2.	Light oils (distilling below 230 degs. Cent.)	5.8
3.	Middle oils (distilling at 230-270 degs. Cent.)	8.3
4.	Heavy oils (distilling above 270 degs.)	23.2
5.	Coke	17.8
6.	Loss	7.7
		100.0

Much frothing occurred until the water was distilled off. Towards the end the temperature went higher than a mercury thermometer will record (360 degs. Cent.). The different fractions obtained were as follows:

(1) Water, faintly acid to litmus. Phenol could not be detected.

(2) Light oils (below 230 degs. Cent.) become rapidly dark red in color. Specific gravity of crude liquid 0.930.

(3) Middle oils (230-270 degs. Cent.) became dark red. Specific gravity of crude liquid 0.944.

(4) Heavy oils (above 270 degs. Cent.) on standing, crystals of paraffin wax separated out to the extent of 5.42 per cent of the fraction (= 1.26 per cent of the original tar). The specific gravity of the liquid portion of this fraction was 0.906.

Analysis of Sample of Peat.

(Received on September 14 from Mr. Hamilton Robb, Portadown.)

Proximate Analysis.

	Per cent.
Water	18.98
Volatile matter	55.17
Fixed carbon	24.75
Ash	1.10

Ultimate Analysis.

	Per cent.
Carbon	44.60
Hydrogen	5.42
Nitrogen	0.97
Ash	1.10
Moisture	18.98
Oxygen (by difference)	28.93
	100.00

Analysis of Average Sample of Gas During a 10 Hours' Trial. Moisture in Fuel 26 per cent.

CO_2	10.6
CO	21.0
H_2	13.0
CH_4	3.7
Total combustible	37.7 per cent
Calorific value (calculated from analysis)	144.0 B.T.U.

The Chem. Trade J. 1912 Vol. 51 p. 134 states that in the discussion which followed the reading of Mr. H. V. Pegg's paper on "Commercial Utilization of Peat for Power Purposes"

(see this Journal, p. 163), Bowman Malcom, expressed the opinion that the difficulty was in following the peat with the preparing plant. Many of the bogs were comparatively shallow, and plant had to be continually following them up. He personally had not very much hope of the ultimate success of the utilization of peat.

Mr. Dixon said that they had got to face modern developments in this question of the utilization of peat. As a mechanical question, peat could be dealt with in a practical manand Sweden than to Ireland, and both of these countries had ner. It is a question of even greater importance to Canada made investigations and had arrived at certain results. However, as long as coal could be purchased at its present prices the utilization of peat need not be discussed. Proceeding, Mr. Dixon said that experiments carried out by his colleagues and himself had produced from one ton of dried sulphate of ammonia which had a marketable value of 17 shillings ($4.12). Recovery of by-products and gas from peat was mechanically a satisfactory process. The question was: is it commercially satisfactory? He thought it might be shown that, carried out on a big scale in a country like Island, given a sufficient quantity of peat and demand for power, and sufficient capital, it would be a paying proposition.

New Italian Peat Plant. Whilst we do not hear and see so much about peat deposits in Italy as in the Northern countries of Europe, it is evident that such exist and that the Italians are wide awake as to their importance and value. There has been for some years past, a large gas-power plant in operation, generating electricity from peat at Pontedera, near Milan, using the Mond type gas-producer with ammonia recovery. This was built by the Power Gas Corporation, Ltd., and has proven so satisfactory that another plant is to be built at Codigoro, in Ferrara, in the near future by the same company.

The Societa per l'Utilizzazione dei Combustibili Italiani, Milan, Italy the Italian company which owns and operates the peat gas-producer and ammonia recovery plant at Pontedera, Italy, has recently completed a tunnel drier for auxiliary drying of the peat used in their producers. The local weather conditions are such that at times the company has difficulty in getting enough fuel with the right moisture content. The company through one of its officers has recently made application for terms of subscription to this Journal.

METHODS OF PEAT FUEL SAMPLING.

(Abstracted by T. A. Mighill.)

The sampling of a large amount of peat fuel for analysis as to its calorific value, the account of moisture it contains, and its ash, requires that the portion selected shall be representative of the whole. This is not as simple as it appears at first sight and a few abstracts from some papers recently published in the Mitteilungen des Vereins Zur Forderung der Moorkultur im Deutschen Reiche may be of interest. In Journal No. 9 Von Lubkowsky of Warsaw calls attention to the difficulties encountered. If different pieces of peat from the same lot did not vary in dryness, hardness, density and chemical composition, the method used for sampling coal might be used. But these variations in peat compel the sampler to use a selective method, removing at regular intervals of time, as the peat is loaded or unloaded, blocks of peat from which smaller samples are taken and so on till the necessary amount for analysis is obtained. From .5 to 1 per cent of the peat should be taken for the first selection in order that the sample may be representative. From each brick ten to twenty grams of material should be removed with a drill of .5 to 1 diameter. These borings should drop into a box through a hole in the cover. They should then be ground in a mill to powder and from the thoroughly mixed mass the sample taken should be put in a close stoppered bottle.

The work should be done as rapidly as possibly to avoid possible loss of moisture.

Von Feilitzen in Jol. No. 11 criticizes the method of Lubkowsky claiming that material removed by cutting through a peat block will not be representative of the whole block. He illustrates this by analyses for moisture on samples taken from the same block of peat in ten different ways, the results varying from 38 per cent to 49.2 per cent moisture, while the true value was 46 per cent. He farther assumes a rectangular block of peat with a core containing 40 per cent moisture, a medium layer around this containing 35 per cent moisture and the outside layer with 30 per cent moisture. He then shows mathematically that peat removed from a hole 15 mm. in diameter right through the block would show 34.07 per cent moisture against 31.87 per cent true moisture or an error of 6.90 per cent of the real value. He then takes a cube of peat giving the layers the same periphery and moisture content. The error here amounts to 10.2 per cent. He recommends that to get representative borings five holes must be drilled along a diagonal. Dr. Wolf of Charlottenburg in Jol. No. 15 criticizes the method

of boring five holes along a diagonal as not always possible for on many pieces of peat it would be impossible to find a diagonal. He doubts if there is any universal method possible. He favors a grinding of the samples and thinks that this can generally be done with the help of simple chopping machines, but when, as Von Feilitzen says, some pieces of peat are tough enough to rive a nail with, grinding has its difficulties.

From the experience of these men, one sees that the sampling of peat is a procedure requiring honesty, judgment and skill.

THE SONG OF THE PEAT ENGINEER.

(Mr. E. V. Moore has received the following poetic inspiration, from the pen of his friend, Mr. W. F. Clemesha, of Oakland, Cal.)

To see the stack a-belchin',
And the rotten little engine
A-coughin' and a-workin'
There so sweet.
While the shovels are a-gruntin'
As they gaily go a-huntin'
And a-munchin' and a-scrunchin'
Up the peat.

To hear the soft contentment
Of the gears a-runnin' sweetly
And the sweatin' men a-swearin'
In the heat.
Hell—that feller should be fired,
Gawd—I'm dirty, sore and tired,
But, there's nothin' like a-dabblin'
In the peat.

—W. F. Clemesha.

A Distinguished Visitor, Mr. E. A. Vajda, of Budapest, Hungary, spent some time in Canada during July, looking into Canadian methods of peat fuel manufacture. Mr. Vajda was the representative of the Society of Engineers and of the Agricultural Society of Austria-Hungary. He visited the various peat plants that were in operation, and especially the gas-producing testing station at Ottawa. Later he visited the farming regions of the West to study agricultural machinery.

PEAT MEETING OF SECTION Vc.

Eighth International Congress of Applied Chemistry.

New York, Monday morning, Sept. 9th, 1912.

Dr. D. T. Day presided. A paper written by Dr. W. Wielandt, on the machinery used at Oldenburg for gathering peat, was read by Dr. Keppeler. This paper was discussed by Dr. von Feilitzen, who asked if the digger might not have difficulty with stumps and buried logs, although admitting that it worked very well on the Oldenburg types of peat. Dr. Keppeler replied that the machine was applicable to woody peat as well as that not so woody. He further stated that the peat coke made by Dr. Wielandt brought $10-$12 per metric ton (2,204 lbs.)

Dr. T. A. Mighill outlined in his paper the work he had been doing for Stone and Webster of Boston, in developing machinery for handling, turning and picking up peat. This paper was discussed by Drs. von Feilitzen and Davis.

Prof. C. A. Davis gave a brief outline of what has been accomplished in the production and use of peat for fuel during the past few years. Dr. Day inquired whether the colloids of peat could be dried and used for absorption and separation of grades of petroleum after the fibers have been removed, no experimental was known in this direction, but the possibilities were that there would be a large use.

Drs. von Feilitzen, Rindler, Keppeler and a noted Russian made an excursion to the plant and farm at Alphano, N. J., as guests of Mr. John N. Hoff, and were entertained by him and other officers of the Society in New York.

Prof. Chas. A. Davis, our Editor, sailed recently (Nov. 14th, 1912), for a short stay in Europe. He was accompanied by Mrs. Davis. During his absence the editorial duties will be assumed by Herbert Philipp, Perth Amboy, N. J., and in as much as the next issue will be in the press before Prof. Davis returns, it is requested that all communications, intended for the Editorial Department of this Journal, should be addressed to Herbert Philipp.

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Communications intended for the Editorial Department should be sent to the Editor, Charles A. Davis, 1733 Columbia Road, Washington, D. C., or to one of the Associate Editors.

EDITORIAL NOTES

One of the uppermost questions in our mind today is—"the high cost of living"—among the numerous items, reasons and explanations given, those interested will have observed room for various arguments pro and con, yet there is one which is of vital interest to our members and friends interested in the cultivation and use of peat. One of the arguments advanced, upon which the majority are agreed, is the higher taxation and increased value of farm lands and waste lands in and near our ever-growing communities.

A large portion of the waste land consists of swampy and peat-muck soils, which is generally abandoned on account of lack-of-knowledge of the holders. Our Society has used its efforts strongly, and with some success, to have such soils put under cultivation. It is, therefore, evident that if all such holdings were put in proper condition, as by direct cultivation, as a source for supplying humus to poor soils or for

power purposes, the increased production from "mother-earth" would tend to lower the "high cost of living"; at the same time the holders would be greatly benefited from a financial point of view.

Of course, to accomplish this end with greater facility on the part of our Society, every effort should be made by our members and friends to increase our membership. Incidentally by increasing the interest in peat by the addition of more members, the "high cost per member" to our Society would be materially reduced, giving the Society greater opportunity of disseminating information and enhancing the value of the Journal to our members. The membership increase would also gradually bring us nearer to the point where the Society could afford to lessen the membership fee without embarrassing the treasury.

Members should induce their friends to join the Society, and can send names of any persons, that they think might be interested in the work of our Society, to the Secretary, Mr. Julius Bordollo, Kingsbridge, New York City.

The Canadian Department of Mines, through Mr. B. F. Haanel, have carried out tests using peat in the gas producer. The article describing these tests will be found in this issue, and our Canadian friends are to be congratulated on the success they have achieved in their work. It is certainly characteristic of the spirit of our neighboring government to start out with a purpose, confronted with difficulties, and yet persevere until definite and useful results are obtained.

Mr. Haanel describes fully the difficulties that beset their tests at the start of their work and fully elucidates the methods and reasons for making the necessary changes and inventions, which finally made their gas-producer a commercial power producer, with peat containing 25 per cent. of moisture as the raw material.

The consumption of fuel per brake, horse-power hour—including stand-by losses—is for full load 1.7 lbs. of dry peat and similarly for ¾ load 2.1 lbs. dry peat. Since fuel burned in the producer does not require to be of the best quality, the fuel cost may be considerably reduced, as broken peat bricks and considerable fines—which always occur in the manufacture of peat and otherwise represent a loss—can be efficiently utilized in the producer. Assuming, however, that peat can be delivered to the plant for $2 per ton, and that the plant is run with a powder factor of 75 per cent. for 300 hours, the fuel costs would be $8.40 per B. H. P. year including stand-by losses. This low figure must undoubtedly be of interest to the power-engineer.

This work of Mr. Haanel represents, perhaps, one of the most useful contributions to the peat literature in recent times, and its applicability to several parts of the United States will be readily anticipated.

The next place of meeting of the Annual Convention of this Society was left in the hands of the Executive Committee. This committee would request the members to make their own choice, so that the majority can rule and select the place of meeting. St. Augustine, Fla., was suggested by our Florida friends, together with all the inducements this active State offers. Montreal, Canada, and Chicago were also mentioned as desirable places for the next meeting. Members are requested to communicate their choice of meeting place for the next Annual Convention to the Secretary.

CORRESPONDENCE.

The Canadian Peat Society. Mr. Arthur J. Forward, Secretary of The Canadian Peat Society, has very kindly written us regarding what our sister Society has been doing during the past year. He writes as follows:

Of actual development in the peat industry in Canada since the Kalamazoo meeting of the American Peat Society last year, there is little to report. Mr. E. V. Moore has been active at Alfred, Ontario, during the summer, erecting and trying a new improved Anrep excavator and other machinery for handling peat fuel on the field. I understand that, while he has only manufactured a small quantity of fuel this season, the results of his work have been satisfactory to the parties interested with him, and that we may expect a substantial output from the Alfred plant next season. Peat Industries Limited have also been active at Farnham, Quebec, but I am not in possession of information as to the outcome of their work.

Dr. McWilliam has also been working at Dorchester, Ontario, and, I understand, will send you a report.

Our Society has made very substantial progress during the year. We have added largely to our membership, and have interested a number of influential people, particularly members of the Commission of Conservation, the Ontario Hydro-Electric Commission, Members of the Dominion and Provincial Governments, representatives of leading railways and industrial companies, universities, etc. The Society has, during the year, taken up the matter of freight rates on peat fuel, having had several conferences with representatives of the railway companies, and having brought up the subject before the Freight Association. However, as we have not yet in Canada any large output

of fuel, the question of special rates remains in abeyance for the present.

We have also taken steps to urge upon the Canadian Government the advisability of making special investigation of the various plants in Europe for the production of power from peat gas, with, and without the saving of by-products. Our representatives in this behalf have had very strong endorsement; action, however, has been delayed owing to the fact that a new Government came into power last September, and the Mines Branch was transferred under a new Minister, but we are hopeful that some definite action along this line will be taken in the near future.

We have begun the publication of a Journal, of which the two first numbers have appeared, and a double number is now in the press. The Journal has been very favorably received, and, we trust, will lead to good results in the development of the peat industry in Canada.

The next general meeting of this Society will be held during the month of October.

We are grateful to Dr. McWilliam, of London, Ont., for the following communication of his progress in peat during the past season:

I think that it may be fairly claimed that Canada is the country where greatest efforts are being made to make the utilization of peat as a fuel successful, while in the United States more attention is being paid to the fertilizer filler.

Both at Alfred and at Farnham, fair success of making fuel by the so-called **wet** process has been reached, and are producing fuel at a profit.

Our own efforts have been devoted to an attempt to make peat-fuel by the **dry** process. I am not able yet to announce success, but we have made such progress this season, I think that we have fully solved the drying question. We use a modified oat drying kiln. It is very effective and cheap to operate and heat. We have built an automobile collector and it has demonstrated that it can do the work. The extreme wet weather has prevented our doing much work with it yet. We are now turning out a good briquette at the rate of 10 tons daily. Delays in getting machines built has cut off most of our good season. But we have still got confidence in our plan, and hope to be able to make a good showing next season. Our output this season will be about 800 tons if we have any dry weather in September.

We have received the following communication: A friend

of mine is looking for a material to use as an absorbent for the seepage about his cattle barn. He has been using a phosphatic marl for some time; but this marl is mostly calcium carbonate in which our soil is not deficient. The soil about here is very heavy ferruginous clay loam, and I have seen humus used to great advantage on it; it occurred to me that it might be worth while to try the same material as an absorbent. What I want to find is a firm offering a pure dry humus or a ground peat with which the experiment could be tried out.

Anyone who can fill these enquiries can obtain the address, by communicating with the Acting Editor.

ITEMS OF INTEREST.

Legislation adverse to the use of peat in fertilizers was introduced at the last session of the Georgia Legislature, but through the excellent work of some of the members of this Society, led by Mr. G. M. Chisholm, of Atlanta, the committee to which the bill was referred was so thoroughly educated as to the real fertilizing value of peat, that no action on the bill was taken and the Legislature adjourned without having it reported out of the committee.

New Peat Scheme. The following item from the Wisconsin, Milwaukee, Wis., Sept. 10, 1912, may prove of interest to some of our readers:

The Irish plan of "curing" peat—that is, getting the water out of it, so that it will burn—has been to separate it and expose it to the summer heat. Theodore Franklin, a Chicago man, now in Dublin, claims to have a process that will "cure" the peat at half the cost and make it so much drier than the old method that it will yield twice the heat. He has interested several capitalists in his device, and hopes to enlist others. Richard Croker, the Duke of Manchester and the Earl of Mayo, who long have been convinced in favor of a more scientific method of dealing with the bog-fuel, have been approached with reference to financing the organization of a corporation to be known as the Irish-American Fuel Company. The matter is still "in the air" to a large extent, but there are those who hope to see it get upon its feet. If it proves successful, undoubtedly the method soon will be used to make merchantable immense resources of peat in many parts of the United States, including Wisconsin.

Commercial Possibilities of Peat as Fuel. The mines branch of the Canada government department of mines states that its demonstration of the commercial possibilities of peat as a fuel in Canada has been successfully completed, and that

henceforth the activities of the branch would be applied in another direction, probably economic production and testing of fuel, concerning which the department has a man in the west. The peat industry in Canada will now become a matter of private enterprise. There are two big plants under construction, one at Alfred, Ont., and another at Farnham, Quebec, which are expected to supply Ottawa and Montreal, and possibly other cities with cheap fuel. Their capacity is about 30,000 tons per year.—World, Vancouver, B. C., Sept. 5, 1912.

Dr. James Wilson, of Van Wert, O., president of the Peats Products Company, of Lakeville, Ind., recently underwent an examination before the receiver of the company. The examination is the result of a statute, passed in 1911, which gives the receiver of a corporation the right to examine its officers. The company has been going through a series of experiments, with the result that when the stockholders found out what they wanted to make they were without funds. Money to carry on the work was advanced by Dr. Mintzer, of Allen county, and some other individuals. After about $18,000 had been spent, a mortgage was executed in favor of Dr. Mintzer, and, when he demanded payment, the stockholders and officers decided to allow him to foreclose without opposition. At the request of William Young, of Lafayette, a stockholder, a receiver was appointed. The examination being conducted is the result of a petition filed by him.

British Invention for Utilization of Peat. A new process for the utilization of peat, invented by F. H. Nixon, of London, consists of cutting the turf, after it has been air dried, into corrugated blocks, which are sprayed with petroleum so as to form firelighters. The blocks are subsequently given a coating of highly inflammable material which also strengthens them and prevents them from breaking easily. It is claimed that this process overcomes the obstacles associated hitherto with the combination of peat and petroleum which have been connected mainly with the employment of a briquetting machine that is not only difficult to work, but also expresses too much of the petroleum from the finished blocks. It is stated that the process enables the firelighters to be produced at a cost which has not been approached before. It is proposed also to employ the method for the production of fuel on a larger scale.—From the London Times.

The problem of maken Sweden independent of foreign coal has lately been receiving much attention, and experiments have been made with peat from bogs in northern Sweden. The peat

was permitted to dry for one summer and then crushed to a fine powder. This is further dried in ovens containing several sections, the hottest section being on top. Heating requires 20 minutes, which makes the pulverized peat black and reduces the water content to 15 per cent. The ovens have a capacity of 25 tons daily, and are fired with the powder, which sells at the factory for $2.27 per ton. It may also be used for boilers, and the State railway authorities are experimenting with it. Generally, however, the tests have not proved satisfactory from an economic and business point.—Consular Report.

Peat-fuel Machinery Wanted. An American consul has forwarded a copy of a letter received from a civil engineer in regard to American manufacturers of peat-fuel machinery. The inquiry relates to a small matter of business and would involve an order of only a few hundred pounds in the first instance. The machinery is intended for use on Irish bogs, and, if successful, considerable development would ensue, not only for peat machinery but also for other classes of machinery. A plant is desired similar to that produced in the United States by the late T. H. Leavitt. Address can be obtained by applying to the Bureau of Foreign and Domestic Commerce, Washington, D. C. In applying refer to file number 9817.

Fire in a Peat Plant. It was reported that the plant of the Columbia Drier Company, at Espy, Pa., was badly damaged by fire in June of this year. It is very difficult to avoid such fires in drying peat for fertilizer filler, and fireproof construction is imperative if damage or entire destruction is to be avoided.

Increased Welsh Patent Fuel Shipment. The patent fuel industry of this district is in a very prosperous condition. This statement is substantiated by the fact that during July shipments of patent fuel (briqueted coal dust) amounted to 106,056 tons, as against 61,830 tons shipped during July, 1911. Several patent fuel plants are contemplating an extension to their works. It will interest those concerned in this industry in the United States to know of the failure of the Welsh Patent Fuel Co., which was manufacturing patent fuel from a so-called secret process in order to secure smokeless fuel. In place of the coal-tar pitch used by the other manufacturers of this district as a binder, this concern used a binder composed principally of corn meal. Whether this departure from the usual process may have been to some extent instrumental for their non-success or not, the principal cause of their failure was the fact that they owned no coal mines and were compelled to buy coal on the open market.

As stated in my general report on the subject of patent fuel (see Daily Consular and Trade Reports for Aug. 4, 1911), I do not believe it is possible to make a commercial success of the manufacture of patent fuel unless the manufacturer has at his disposal a cheap source of supply of otherwise waste fuel. The only successful manufacturers of this district own their own mines and use their slack for the manufacture of patent fuel.—From Consul C. Ludlow Livingston, Swansea, Wales.

OBITUARY.

L. C. Wolff, Ph. D., director of the Technical Section of the German Peat Society, died on Aug. 17th, at Charlottenburg, Germany.

His services in the interest of peat are world renowned and commence with his report on the Ziegler Process for the Prussian Government. His contributions to the peat literature are many and his publication, "Development of Peat Culture in the Last Twenty-five Years," is perhaps the best known. The progress of peat for power purposes in Northern Germany are partly due to his untiring activities. The peat world has lost a valuable worker and practical peat engineer. H. P.

REVIEWS AND ABSTRACTS OF RECENT PUBLICATIONS ON PEAT.

(Publications and articles intended for review in these columns should be sent to Dr. Herbert Philipp, Exchange Editor, Perth Amboy, N. J.)

Class I.—Peat Plant and Machinery.

Apparatus For Pressing Peat. T. Franke, Berlin, Germany. British Patent 24,819 (1911).

This invention relates in particular to machines of the well-known type comprising a compressing chamber provided with strainers for enabling the liquid to escape from the material while being compressed in the chamber. The invention consists in certain improvements the objects of which are to render such machines more efficient than hereto in the expulsion of the liquid and to improve their construction. One improvement consists in the provision of the strainers with teeth, the purpose of which is to tear up and open the smooth outer surfaces of the material while it is being compressed so as to facilitate the flow of the liquid through the outer layer of the material, which, when the well-known wire gauze strainers are used, offers great resistance to the outward flow of the liquid on account of the said outer layer being of a mud-like or pulp-like nature caused by the deposition of fine particles carried by the

liquid expelled at the commencement of the compression operation. Another improvement consists in the provision of piston packing-rings in the form of elastic metallic wires for the purpose of satisfactorily packing the pistons in compression chambers fitted with strainers provided with the above mentioned teeth. Another improvement consists in the provision of combustible partitions in the material to be pressed for the purpose of deflecting the liquid to the exterior of the material without it being necessary to remove said partitions if the material is to be used for fuel. Other improvements consist in the concentric arrangement of the pistons in the compression chambers; in the provision of double-acting strainers with unperforated cores preventing liquid from flowing through the strainers from one side to the other; in the provision of an improved hopper adapted to hold the strainers in position during the charging operation. H. P.

Excavating of Peat. T. Rigby and N. Testrup. English Patent 13281 (1911).

The invention consists in a method of gathering peat in which an excavation of the bog or deposit, of limited size but of capacity to contain a supply of peat sufficient for the cold period, is kept distinct from the main excavation of the bog, and is used to contain a sufficient quantity of the peat for the normal working during the cold period, the excavation being of such depth that freezing cannot under ordinary cold conditions occur to excessive extent. In carrying the invention into effect, and employing the method of gathering peat, in which the excavating implement delivers the material directly to a disintegrator or pulveriser, wherein it is converted into a watery pulp, which is then pumped through a pipe line to the desired locality, a certain area is first excavated in the usual way to such a depth that when peat is stored in it, the temperature which occurs in the cold season will be insufficient to cause more than a surface freezing. The capacity of the excavation is made such as to contain a supply of the peat sufficient for, say, six months of normal working. The peat excavated is sent through the pipe line and employed in the usual course. When the desired size of excavation has been attained, work is commenced on the main portion of the bog, and the pontoons bearing the excavator, disintegrator and pump may be floated into the main excavation by cutting away a portion of the uncut bog forming the wall between the excavations, which cutting is subsequently dammed up. The operation of gathering is now carried on in the usual way in the main excavation, care being always taken that a sufficient supply of material is kept stored in the first excavation to tide over the cold season. It is desirable to instal a permanent pumping station in the first

excavation with a peat intake situated well below the normal surface of the peat, so that the material may be supplied with the assistance of gravity. H. P.

Working of Peat. A. Hendune. German Pat. 233,809. Nov. 7, 1908.

In the working of peat and like material, with the employment of centrifugal action, placing between the packing drum and the cord press a drum adapted to be rotated rapidly and provided with fixed knives arranged lattice-like on the wall of the drum. (Through Chem. Abstr.) H. P.

Class II.—Peat Fuel and Briquets.

Peat Briquettes. J. McWilliam. (Jour. Can. Peat Soc., 1911. Vol. I, p. 13.) A brief description of Milne's process for collecting drying and briquetting peat at Dorchester, Ont., is given here. This process has been described in this Journal. H. P.

Peat Dust Fuel. The Swedish engineer, H. v. Poncit, has constructed a fire-grate, whereby it is possible to heat locomotives and steamboats with powdered peat. After several preliminary experiments during March, a train, with twenty-five loaded cars, was run over the railroad between Stockholm and Rimbo. During this run both the apparatus and fuel proved satisfactory. The length of the run was 200 kilometers. H. P.

Production of Fuel Briquettes. N. Testrup. English Pat. 11554 (1911). This invention consists in a briquetting process for wet carbonized peat in which the material is freed from water in a filter press and drying completed to the desired extent, or in which the material is in some other suitable way given high porosity and the briquetting is then effected by rapid compression. In carrying the invention into effect in one form, the wet carbonized peat pulp, after it leaves the carboniser, is freed from the bulk of its water in a filter press, the resultant cake being then dried in a suitable drier directly or after suitable further treatment in a press of a different type. The moisture content may in this way be reduced to 8 or 10% or thereabouts. The material, which has been heated in the dried to about 100° C., may now be fed directly into a suitable briquetting press. The press which it is preferable to employ is one of the open die type. If tapered dies are employed care should be taken that the taper is not excessive and such as to lead to a disturbance of the pressure distribution, it having been observed that if dies of too great a taper are employed a product lacking in homogenity may result. In such a case the product has a brownish hue in parts, as against the black coal-like appearance which it possesses when properly briquetted. H. P.

Peat Briquetting. H. G. Mashek. (Chem. Eng., Vol. 16,

p. 94.) The author recommends carbonizing the peat and briquetting the carbonized material. This carbonizing process will include the production, among other things, of sulphate of ammonia. Dried peat sometimes contains 3% or more ammonia. In using peat for fuel all this ammonia is lost. If the material is carbonized in by-product ovens, practically all of this ammonia will be recovered and will be available to the fertilizer market. (Through the American Fertilizer.)

H. P.

Class III.—Peat Distillation and Coke.

Method of Coking Coal and the Like. E. Enke. British Pat. 22696 (1911).

This method relates to a method of coking coal of inferior quality, peat, lignite, wood waste and the like. According to it, the coking materials, such as coal, lignite and younger fossil fuel, are compressed to a high degree by means of briquette or like pressing machines, into small briquettes, cakes or any other shapes to which a great density can be imparted. Previous to the compression a binding agent, such as pitch, tar or the like is added to the materials, the adhesiveness of the latter and the density of the carbonized coke being thereby greatly enhanced. The compressed materials are finally fed continuously through a coking chamber or passage by suitable transporting means—for instance, mechanical gratings, refractory conveying bands, racks or the like. For the purpose of protecting the distillate as far as possible against decomposition, the materials are, at least partly, heated by means of steam which is superheated to coking temperature and introduced directly into the coking chambers through the walls of the latter. The method allows of complete carbonization in about three hours, a fact which considerably increases the density of the resultant coke.

Peat Coke Steam. 1912. Vol. 10, p. 122. An unusual form of gas producer has been invented by a German engineer, M. Ziegler, and patented by Wangemann, in which bituminous fuels, like peat, lignite, etc., etc., are treated for manufacturing gas and coke in separate chambers side by side, one chamber used always for gas production and the other for coke making. The producer is intended for use where the demand for power on the gas engine is intermittent, while the plant may remain working at good capacity for making coke. H. P.

Class IV.—Peat Gasification.

Use of Peat in Gas Producers. Steam, Vol. 10, p. 92. The Zeitschrift des Vereines Deutscher Ingeneieure recently reported a test of a 300 H. P. peat gas producer and engine, built by the Goerlitzer Maschinen Anstalt, which showed the peat

composition per K. W. hr., measured at the switchboard, of 4.4 lbs. The peat was notably low in moisture, the analysis being 41.65 per cent. Carbon, 4.1 per cent. Hydrogen, 26.35 per cent. Oxygen, 4.1 per cent. Ash and 23.8 per cent. Water. The engine was double acting, with a cylinder diameter of 25½", a stroke of 29½" and a speed of 150 R. P. M. The mean heating value of the peat was given as about 7100 B. T. U. per pound.

H. P.

Peat as Gas-Engine Fuel. T. Tomlinson, Power, Vol. 35, p. 660. The use of peat for power production on the bog has an advantage over peat as fuel off the bog in that the peat need not have its water content reduced below 60 per cent.; also the conditions for the recovery of ammonium sulphate would be more favorable. The plant at Osnabrück, Germany, which is situated on a bog, is described. (Through Chem. Abstr.)

H. P.

Peat in Gas Producers. Societa per l'Utilizzazane dei Combustibili Italiana. Bi. P. 17,436, (1911).

Owing to the very large proportion of water contained in peat and like materials, it is impossible to utilize the peat in a gas producer without first drying it. It has been proposed to burn one portion of the peat in a furnace adapted for drying another portion, but this is not economical. However, when the gas producer is used as part of a plant, for the production of power or the heating of furnaces, the heat contained in the waste gases from the plant suffices, when properly applied, to dry the peat to the degree at which it can be successfully gasified in the producer. According to the invention these hot products of combustion of the gases from the producer are passed over or through the peat after it has been dried by pressure or by disintegration and subsequent drainage, as far as is practicable. These products of combustion may be the flue gases from steam generators, or the waste gases from a heating furnace. As they are comparatively small in volume but at a higher temperature than is necessary, it is better to dilute them with air before they are passed through the peat. It is found that when the gases have passed through the peat they still contain sufficient heat to raise the steam for the blast of the producer when the latter is to be worked with recovery of ammonia, the preferred method of utilizing the heat for this purpose being to bring the gases into contact with water, which becomes hot enough to yield steam to air subsequently passed through the water on its way to the producer. A method of operating a gas producer with peat consists first in drying the peat, then shaping it in the form of lumps, about 3 or 4 in. diameter, then drying these lumps by hot gases passed over

them, whilst these lumps are caused to travel in an opposite direction in such a manner that the whole of the heat is not removed from the gases. H. P.

Peat in Europe and Canada. J. Ind. & Eng. Chem., 1912. Vol. 4, p. 689.

In 1907, the peat industry of Europe was investigated by the Department of Mines of Canada, and later a report was published in which the European practice was discussed in detail. In order to determine the possibilities of peat fuel for industrial purposes, the Department purchased some 300 acres of peat bog and has been experimenting with the foreign systems. In the manufacture of air-dried fuel from peat bogs, the peat has been dug by hand, transferred by an elevator into a mill, the resulting pulp conveyed by cable cars to the drying fields, rolled into a sheet about 4 in. thick by a press, and divided by knives into blocks which are then dried on the field. Allowing 140 days for a season's work, the cost of fuel on the field is said to be $1.40 a ton and when stored in the shed, $1.65 per ton. In Sweden, the cost of a plant for the manufacture of 20,000 tons of peat powder by the Ekelund system is $86,000, and the cost of producing one ton is $2.30; in Canada, however, the cost per ton is higher, for common labor in Sweden gets a wage of but $1.00 to $1.22 per day of 10 hours. While peat powder has been found to be satisfactory as a fuel in Sweden, because of the expense of production, waste of available nitrogen, etc., Eugene Haanel, the Director of the Department of Mines of Canada, has concluded, after considerable experimentation, that the proper method is to gasify the peat in a suitable producer, along the lines of the ideas advocated by Frank and Caro, and also applied in Ziegler's peat gas-producer; and considers that in order to make the peat industry profitable, a 20-hour day, working two shifts, must be adopted, as the real season for working a Canadian bog is not over 110 working days a year.

Class V.—Peat Products: Ammonia, Tar, Oils, Etc.

Uses of Peat in Europe. Steam, 1912, Vol. 10, p. 74.

In the growing use of peat in Europe, its value as a gas-producer is important, the resulting "producer gas" having a recognized high value for fuel and power. In a recently perfected gas-producer it has been found that in converting peat containing a good percentage of nitrogen into a gas a large amount of ammonia, greatly valued as a fertilizer, can be obtained as a by-product. A report quoted shows that where gas-producer plants using peat are carefully managed so great are the profits obtainable that it is often possible, while taking no credit whatever for the value of the power gas, to obtain as

much as 100% profit from the sulphate of ammonia alone, after making proper allowance for the cost of digging the peat, bringing it to the plant, and for the labor, stores, capital, shares, etc. Indeed, with peats comparatively poor in nitrogen, it is possible in many cases to produce the gas for nothing, the cost of the power being merely that of operating the gas engines, together with capital charges on the same H. P.

Class VII.—Peat Deposits and Soils.

Fires as a Benefactor and Enemy in the Cultivation of Peat.

H. Schreiber, Oest. Moorzt, 1912, Vol. 13, p. 81.

Peat deposits were fired already in Virgil's time (30 years B. C.), and the methods of firing to-day in Austria, Germany, Holland and Finland are carefully and fully described. It appears that by burning the peat deposit the cheapest method for hoeing, ploughing and harrowing is obtained. From a physical point of view it offers the advantage of not becoming hard in the dry seasons and allows therefore better aeration at this time; care, however, must be taken not to allow the fire to penetrate too deep. The beneficial chemical influence is due to the noxious oxides being converted into harmless oxides and makes the phosphoric acid more soluble and therefore easier to assimilate by the plants.

The disadvantages of burning the peat are many fold. The beneficial results of burning the peat deposit are very uncertain, in fact the author deplores this method of procedure in the cultivation of peat deposits for agricultural purposes. After defining the several known methods for extinguishing peat deposit fires, and its harmfulness if lost control of, the author gives good counsel by stating, "Better one man at the beginning than one hundred in an hour." H. P.

Unproductive Black Soils. S. D. Conner and J. B. Abbot. Ind. Agri. Expt. Sta. Bul. 157, 1912.

Indiana contains several hundred thousand acres of black soils, though some progressive men are clearing annually $100 per acre on special crops, such as onions, celery, peppermint, etc. Thousands of acres remain unproductive and the authors deplore this condition and clearly set forth methods for turning this unproductive soil into fertile land.

Proper system of drainage should be arranged for before any permanent improvement can be accomplished. These soils, peat and peaty sand, are chiefly deficient in potash contents, which can be easily applied to the same; most of these soils show acid properties and should be treated with lime or limestone, and on such soil phosphoric acid should always be added after treating with lime. As these soils are well supplied

with nitrogen and organic matter, there is no need of supplying these by artificial means.

The authors recommend making field plot tests to determine the fertilizer's necessary, as chemical tests are too unreliable to determine the requirements.

Cranberry Bog Management for Wisconsin. O. G. Mlade. Wisc. Agri. Expt. Sta. Bul. 219, 1912.

The flooding of new bogs and reflooding, when night freezing becomes severe enough to heave the plants, appears necessary; this reflooding in the late cold snaps in spring acts also as a protection. The author states that sanding and clean culture automatically protects from frost, as has many times been shown by the immunity of the station bog when other bogs, near by, suffered severely from frost. The addition, in winter, of a quarter of an inch of sand over the surface of the bog every second or third year, encourages the rooting of the runners.

The author recommends as fertilizers 240 lbs. acid phosphate, 80 lbs. nitrate of soda and 80 lbs. sulphate of potash. He states further that the yields, on clean sanded bogs, is four times as great as on semi-wild bogs and there is a great decrease in cost of harvesting. H. P.

Alfalfa as a Wisconsin Forage Plant. R. A. Moore. Wisc. Expt. Sta. Circular 35, 1912.

The circular denotes the importance of alfalfa growth in Wisconsin and gives information for the selection of soils (including peat soils) in Wisconsin to get best results in that state and be guarded against the climatic characteristics of that country. H. P.

Some Constituents of Humus. Dr. Edmund C. Shorey, U. S. Laboratory of Soil Fertility Investigations. Inter. Congr. Appli. Chem., 1912.

The term humus is used to designate that portion of the organic matter of soils soluble in dilute alkalies. In such solutions of humus 35 definite organic soil constituents have been isolated, and may be classified as follows: 13 organic acids, 9 organic bases, 3 sugars, 2 aldehydes, and 1 each of hydrocarbon, glyceride, resin, ester, acid, anhydride, sulphur compound and phosphorus compound. The constituents may also be classified into those which may be precipitated by acidfying the alkaline solution (phytosterol, histidine, arginine, xanthine, etc.) and those which remain in solution on acidification (oxalic, succinic, saccharic acids, choline, mannite, etc). Not more than one or two of the organic compounds isolated were obtained from any one soil. The methods of isolation included separation with immiscrible solvents, precipitation with salts of phosphotungstic

acid, and salts of lead, silver, mercury and copper, and distillation with steam or in a vacuum. The results so far achieved demonstrate the complex character of humus and at the same time indicate that the whole of this organic material can be determined by means of modern methods of research. (Through American Fertilizer.) H. P.

Investigations of the Nitrogen Economy of the Soil. W. Schneidewind. Landw. Ztg. Fuehlings. Vol. 60, p. 780.

Three years' comparison of fallow with soil growing turnips, oats and potatoes showed losses up to 85.5 lbs. nitrogen per acre in fallow plats. The loss was chiefly in the drainage, though partly as free nitrogen and ammonia. Less nitrogen was lost in cropped soils, not considering that assimilated by the plants; considering assimilated nitrogen, there was a gain of 29.5 lbs. per acre yearly. Total nitrogen assimilation was reduced by application of straw and sugar, although the total nitrogen content of such plats was the same as of unfertilized plats and plats fertilized with peat. (Through Chem. Abstr.)
H. P.

Class VIII. Peat Drainage.

Effect of Drainage of Peat Deposits on the Growth of Trees. Oest. Moorzt. 1912. Vol. 13, p. 75.

At the peat testing station of the Swedish Peat Society at Joenkoeping it has been shown that a much larger addition of wood per year to the trees since the drainage than before.
H. P.

Measurement and Division of Water. L. G. Carpenter. Colo. Agri. Expt. Sta. Bul. 150, 1911.

This bulletin gives the history of the division of water, explaining at length the common forms of divisions, regulators, modules and weirs. Full instructions regarding methods of calculations are included and valuable tables computed from the formulae in the bulletins are appended. H. P.

Class XII.—Miscellaneous Abstracts.

The Role of Peat in the Formation of Coal. Indian Engineering, 1912, Vol. 51, p. 312.

In an article entitled "Coal—Its Origin and Geology," the following of interest appears: The scale consists of peats, lignites, brown coals, cannel coals, humic (or bituminous) coals and anthracite, which contains a graduated percentage of carbon increasing from peat and a graduated percentage of hydrogen, oxygen and nitrogen decreasing from anthracite. That coal passes gradually from the peat to the anthracite stage was once held, but has now nothing to support it. Peat is, of course, the

most elementary form of coal derived from mosses growing in the swamps which are attacked by ulmic and humic acid, and also by bacteria, the decayed moss reaching the stage of peat when the acid and bacterial actions have ceased. Brown coals and lignites are peats that have undergone further bio-chemical change, assisted by pressure under recent strata. The other coals have an independent origin, and there is evidence that they formed more quickly than would have been possible had they been slowly evolved from peat. H. P.

The X-Ray Examination of Peat. Colliery Guardian, 1912. Vol. 104, p. 15.

The author (Henri Couriot) maintains that X-rays afford fresh means of ascertaining the greater or less degree of purity in mineral fuels. In carrying out his examinations a Rhumkorff coil was employed, with an independent interrupter, the specimens being interposed between the vacuum tube and a florescent screen. Fragments were chose having a nearly constant thickness of 2 cm., or one just double. In reviewing the radiographs, it is observed that the impurities alone influence the shade presented by the specimen under consideration.

Comparisons of hard coal, soft coal, lignite and peat make it evident that the content of the volatile matter does not influence the shade, but that the latter is only affected by the proportion of mineral matters; the cloudy appearance of the peat radiograph shows that it is largely impregnated with earth. H. P.

The First Fossil Find of the Low Birch in Austria. H. Schreiber, Oest. Moorzt, 1913, Vol. 13, p. 65.

The author discovered, on April 17th, 1912, in the neighborhood of Eger, Austria, a low birch peat at a great depth. As this tree is only known now in the cold regions, the author claims this as a relic from the ice period. H. P.

Peat Baths in Bohemian Woods. Oest. Moorzt, 1912, Vol. 13, p. 61.

The St. Margaret's Baths, near Prachatitz, in Bohemia, have acquired a peat deposit to use as peat baths. Tests by Dr. W. Ginll have proved them valuable as cure-baths. Outside of its strong radio-active properties it has other valuable curatives. Prospectuses can be obtained from "Kurverwaltung des St. Margaretenbades, bei Prachatitz, Bohemia." H. P.

Ekenberg Process. Sinn Fein. Dublin, Ireland, Sept. 7th, 1912.

We have received a copy of this publication through the Irish American Peat Association. The article, after stating that Dr. Martin Ekenberg's process proved a failure in Sweden, shows in detail the financial methods and stock distribution used to exploit the patents in question. H. P.

Constitution and By-Laws of the American Peat Society

Adopted at the 6th Annual Meeting, New York, Sept. 7th, 1912.

ARTICLE I.

Name.

The name of this organization shall be American Peat Society, incorporated under the laws of the State of New York in 1912.

ARTICLE II.

Objects.

The objects of this society shall be to investigate and encourage the utilization of the vegtable products known as peat, muck, turf and bog deposits. To gather and disseminate information in connection with such peat, turf and bog deposits, and to direct or conduct experiments in peat utilization should the Executive Committee deem it expedient.

ARTICLE III.

Membership.

Section. 1. Any person who is interested in peat, turf or bog deposits is eligible to membership in this Society.

Sec. 2. There shall be three classes of members, viz., Honorary Members, Life Members and Members.

Sec. 3. Persons distinguished in the art of the utilization of Peat or cognate products or in the encouragement of the utilization of the same, may be elected to Honorary Membership. An Honorary Member shall be entitled to all the privileges of membership, but he shall have no right, title or interest in any of the property of the Society. The number of Honorary Members shall not exceed ten residents of the North American Continent and ten residents of foreign countries.

Sec. 4. Life Membership shall be restricted to those who shall pay to the Society One Hundred Dollars in place of Annual Dues. They shall be entitled to all the privileges of membership.

Sec. 5. Any eligible person may be elected to membership.

ARTICLE IV.

Trustees.

The management of the affairs, funds and property of this Society shall be vested in an Executive Committee, which shall number nine members, which number shall include the Officers of the Society.

ARTICLE V.

Officers.

The officers of this Society shall be a President, two Vice-Presidents and a Secretary and Treasurer.

ARTICLE VI.

Election of Officers.

Section 1. The officers shall be elected annually and shall hold office for one year or until their successors are elected.

Sec. 2. At each annual election there shall be elected five Executives to hold office for one year or until their successors are elected.

ARTICLE VII.

Amendments.

Section 1. This Constitution may be amended at any Annual Meeting of the Society by a vote of two-thirds of all members present and voting, provided:

1st. That the proposed amendment shall have been first submitted in writing to the Executive Committee and shall have been approved by them, and

2nd. That notice of the proposed amendment, so approved, shall be given to the members of the Society at least thirty days previous to the annual meeting, and that the proposed amendment in full or part, shall form a part of the notice of the meeting at which final action is to be taken.

Sec. 2. In the absence of the approval of the Executive Committee this Constitution may be amended by a three-fourths vote of the Society, provided all other conditions herein specified shall have been complied with.

The Committee appointed by the Kalamazoo meeting has drawn up the following by-laws, which will come up for action at the 6th annual meeting:

I—GOVERNMENT.

Section 1. The Executive Committee shall have general charge of the affairs, funds and property of the Society, and of all other matters not otherwise herein provided for.

Sec. 2. Meetings of the Committee shall be held upon the call of the President of the Society, or upon the request of two members of the Board and a quorum shall consist of three members.

Sec. 3. The Executive Committee shall pass upon the qualifications for admission of membership to the Society. It shall have the power to suspend or expel any member of the Society by a majority vote of the whole Board. It shall also act upon any resignations of membership.

Sec. 4. The Executive Committee may fill any vacancies in its body by the election of any member of the Society, who shall serve until the next annual election.

II.—DUTIES OF OFFICERS.

Section 1. It shall be the duty of the President to preside at all meetings of the Society. He shall be chairman of the Executive Committee, and he shall with the Secretary-Treasurer, or in his absence with the First Vice-President, sign all written contracts and obligations of the Society.

First Vice-President.

Sec. 2. It shall be the duty of the First Vice-President to act in the absence or disability of the President. He shall also be a member of the Executive Committee.

Second Vice-President.

Sec. 3. It shall be the duty of the Second Vice-President to act in the absence or disability of the President and First Vice-President. He shall also be a member of the Executive Committee.

Secretary-Treasurer.

Sec. 4. The Secretary-Treasurer shall keep the minutes of all meetings of the Society and of the Executive Committe; he shall notify members of their election, issue notices of all meetings, conduct the correspondence, keep the records of the Society, collect all moneys due the Society and perform such other duties as may be assigned him by the Executive Committee. He shall deposit all moneys due the Society in such institutions as may be authorized by the Executive Committee. He shall pay all bills approved by the Committee, and shall make a report to that body when so requested. He shall present at the annual meeting a written statement of the financial condition of the Society.

III.—COMMITTEES.

Section 1. The President of the Society or the Executive Committee may appoint for the benefit and interests of the Society, and determine the scope of their work.

IV.—MEMBERSHIP.

Section 1. Candidates for membership in the Society shall be proposed by one member, in writing.

Sec. 2. Nominations for Honorary Membership shall be made by the unanimous vote of the Executive Committee.

Sec. 3. A member-elect who fails to pay his dues within sixty days from the date of his election, thereby forfeits his rights to qualify, unless permitted to do so by vote of the Executive Committee, after the payment of the proper dues has been made.

V.—DUES.

Section 1. The membership dues shall be five dollars per year or as provided by the Constitution.

Sec. 2. Members elected within two months of the time when the annual dues are payable, shall be exempt from the payment of the dues for the current year.

VI.—MEETINGS.

Section 1. The date of the annual meeting of the Society for the election of officers and the transaction of other business, shall be fixed by the Executive Committee.

Sec. 2. Other meetings of the Society can be held at the call of the President or of the Executive Committee or upon written request of five members in good standing, addressed to the Secretary-Treasurer. Notice of such meeting shall be mailed to each member at least seven days before the date of the meeting.

Sec. 3. At the annual meeting, fifteen members shall constitute a quorum, and at other meetings, ten members.

VII.—PUBLICATIONS.

Section 1. The Society shall publish a Society organ, the same to be edited and published as the Executive Committee shall provide.

VIII.—SECTIONS.

Section 1. Whenever twenty or more members located in any part of the world shall so desire and shall secure permission of the Executive Committee, they may organize a Section, to be presided over by a chairman and may hold meetings at such times as may be decided upon by a majority of the members of the Section. The expenses of such meetings, not exceeding 20 per cent. of the amount of the membership fees paid in by the members of the Section, shall be paid from the general funds of the Society, on presentation of itemized accounts of all expenditures.

IX.—AMENDMENTS.

Section 1. These By-Laws may be amended by the votes of two-thirds of the members of the Society present at any meeting, provided that the proposed amendment shall have been approved by the Executive Committee and mailed to every member at least ten days before the meeting at which it is to be considered.

STATEMENT OF OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., of The Journal of the American Peat Society, published quarterly at Toledo, Ohio, required by the Act of August 24, 1912.

Editor, Charles A. Davis, 1733 Columbia Road, Washington, D. C.

Managing Editor, Francis J. Bulask, Toledo, Ohio.

Business Manager, Julius Bordollo, Kingsbridge, New York, N. Y.

Publishers, The American Peat Society, Kingsbridge, New York, N. Y.

Owners: The American Peat Society, Incorporated as a Scientific Society, under the laws of New York.

Known bondholders, mortgagees, and other security holders, holding 1 per cent. or more of total amount of bonds, mortgages, or other securities: None. CHARLES A. DAVIS, Editor.

Sworn to and subscribed before me this 8th day of November, 1912.

CLARENCE B. DUTTON, Notary Public.

(Seal) (My commission expires Sept. 7th. 1916.)

Journal of the American Peat Society

VOL. V. DECEMBER, 1912 No. 4

THE AGRICULTURAL VALUE OF PEAT LANDS.

*Prof. W. R. Beattie, St. Louis, Mo.

(Read at the New York Meeting.)

In looking up the literature relating to the uses of peat we find a vast amount upon its commercial value, but very little upon its agricultural possibilities. We also find that very little progress has been made toward solving the problems that surround the successful employment of peat soils for the production of farm and garden crops.

As early as 1794 Rev. James Anderson, of London, England. published a treatise on Peat Moss, dividing his attention between its use as fuel and for the production of farm crops. Our most important early works upon "Moss-Earth" were those by Bennie and Aiton, issued about 1810. In the preface of Aiton's work the author calls attention to the need of experiments and observations, stating that "when the subject shall have attracted more general notice, when proper experiments have been made on moss soil, and men of greater erudition and abilities have begun to pay attention to the subject, discoveries of much greater importance may be made, and more correct ideas formed on the qualities and uses of moss-earth."

In 1859 Dr. Samuel W. Johnson, professor of Analytical and Agricultural Chemistry of Yale College, published a series of essays on Peat, Muck, and Commercial Manures. Again in 1866 the same author issued a book upon "Peat and Its Uses as Fertilizer and Fuel." In this work Dr. Johnson discussed the use of raw peat for applying directly to improve the texture of the soil, mainly through its power of absorbing and holding water, its power of absorbing ammonia, its influence in promoting the solution of mineral ingredients of the soil, and its own nitrogen content as a source of plant food. In this work the term "peat" was evidently applied to the raw and fibrous material such as is found in a bog which is still in the process

* Recently of the V. S. Department of Agriculture.

of formation. Great stress is laid upon the importance of "weathering" the material before applying it to the land. Under the term "weathering" the author was including all of the bacterial changes of nitrification, etc., which at that time were little understood. We find in this work the statement that "The nature of the chemical changes induced by 'weathering' is to some extent understood, so far as the nitrogen, the most important fertilizing element, is concerned. The nitrogen of peat, as we have seen, is mostly inert, a small portion of it only existing in a soluble or available form."

In the annual report of the State Geologist of New Jersey for 1905, we find a short discussion of the agricultural uses of peat, first, as a filler or drier for fertilizers, and second, as litter for bedding in stables. This report also calls attention to the undesirability of applying the raw peat directly to the soil because of its so-called antiseptic qualities. Under the use of peat as a filler for commercial fertilizers the author states that "This use of peat is quite legitimate for it enables the manufacturers to produce a fertilizer of superior mechanical condition. From the customer's standpoint, the use of peat as a filler is objectionable when the manufacturer includes the peat-nitrogen in his guarantee and charges for it the same price paid for high-grade organic nitrogen." This report further states that the average of thirty samples of Connecticut peat examined by Dr. Johnson showed a nitrogen content of 1.75 per cent. The nitrogen of peat when the latter is directly applied to the soil yields slowly to decay, in fact, some authorities are inclined to consider it of no value as a source of nitrogen. Storer is inclined to think that a portion of the peat-nitrogen may become available within a year. That in spite of its inertness, it is a matter of familiar observation and experience that the peat-nitrogen does contribute to the growth of crops and is of value. The report further states that the peat of a coarse or fibrous nature is used extensively as litter, mainly for bedding in stables. For this purpose it should be loose and free from solid lumps. The air-dried material contains not more than 20 to 30 per cent. of moisture and in this form has a high absorptive power. A good litter will absorb eight times its own weight, whereas straw will absorb only three times.

Peat litter not only prevents the waste but also conserves the value of the stable refuse by retaining the ammonia that would otherwise be set free. Peat forms a clean, sanitary bedding, and where obtainable, at a much lower cost than for straw.

Numerous other uses for peat are mentioned in this report, none of which, however, relate to the use of the decomposed peat for growing crops.

In Bulletin 376 of the United States Geological Survey, en-

titled Peat Deposits of Maine, numerous uses are given for peat including its use as a filler for fertilizers and as soil for the production of crops. In Bulletin 16 of the Department of the Interior, Bureau of Mines, the author, Professor Davis, very ably reviews the entire field of peat utilization including a chapter on the agricultural uses of peat. In this work Professor Davis calls attention to the fact that while a large amount of investigation of peat soils from an agricultural standpoint has been conducted in England and other European countries, that we in the United States, owing to the abundance of other lands, have given very little attention to the problem. In this work the author has touched the keynote of the whole situation in the statement to the effect that peat or muck soils are benefited by the addition of stable or barnyard manure which add to the soil the bacteria necessary to hasten decay and promote humus formation.

Muck is the decayed or decomposed peat and it is in this condition that we shall now consider it from an agricultural standpoint. The earliest writers upon the subject realized the necessity of drainage and areation in order to render peat or muck soils productive. They knew the necessity; we in a measure know the "why" of the matter, but much remains to be done.

Scattered throughout the United States and Canada there are vast areas of muck lands that offer great possibilities from an agricultural standpoint. These soils are not adapted to the production of all kinds of crops, but a comparatively limited number only, and in order to produce these profitably certain specific conditions must be complied with. It is only within the past forty or fifty years that any extensive use has been made of muck lands in this country for farming or gardening purposes. Some of the notable instances of the profitable cultivation of muck lands are found in the celery fields of southern Michigan, northern Ohio, southern New York, northern New Jersey, Florida, southern California and elsewhere, also in the onion fields on muck lands in Indiana, Ohio and New York. In many cases the production of crops upon muck lands has been phenomenal, but on the other hand large tracts of muck have failed to yield profitable crops after two or three years' cultivation. Many persons have gained the idea that if a soil is black that it is necessarily rich in plant foods. In the decomposition of peat and the formation of muck the fibrous matter changes gradually from a brown to a black color, at the same time a limited quantity of plant food becomes available. With the exhaustion of the small supply of plant food contained in the decomposed portion of the peat the land becomes unproductive.

In the consideration of the requirements of muck lands for agricultural purposes we have the following important points:

1. Muck soils are formed only under conditions of poor natural drainage, and the provision for suitable drainage is the first and most important essential.

2. Muck soils are deficient in bacterial life and it is necessary to build up the minute soil flora.

3. Muck soils are as a rule sour, and this acidity must be corrected by the application of lime and by areation. Exceptions to this rule are found in the muck or peat beds that are underlaid by a stratum of marl or highly calcareous sand.

4. Muck soils are as a rule deficient in potash and are greatly benefited by the application of potash salts, wood ashes or some other potash carrying material.

5. Muck soils have a strong affinity for water and must be kept more nearly the saturation point than other soils.

In reaching these conclusions we are guided mainly by the practical experience of persons who have undertaken to grow crops upon the muck soils. We have at our command the results of a few laboratory tests with fertilizers, but these have not been conducted along any definite relative lines and can be considered in the light of indications only.

Taking the several points in their order we have first to consider drainage. As already suggested, the muck areas are not naturally drained, and in fact, are often very difficult to drain. While it is desirable to provide for lowering the water table in the muck soils to a depth of four to six feet, provision should also be made for retaining the water and raising the level of soil saturation at times to within a few inches of the surface.

The method of draining will depend upon local conditions. Very often the securing of drainage of these areas must be made a cooperative or public undertaking, and must be handled on a large scale. This generally included careful surveys and the dredging of main canals or ditches, sometimes miles in length. The lateral drainage is generally accomplished by the land owners and consists either of open ditches or tile drains. The great objections to open ditches are the space that they occupy and the difficulty in keeping them open and free of weeds. The first cost of tile drains is greater, but if properly installed there is little expense for maintenance. In many cases a combination of tile drains and open ditches is found most satisfactory. The tiles may often be made to serve a double purpose both for drainage and irrigation. The celery growers of Sanford, Florida, have for many years employed a combination of irrigation and drain-

age on their muck lands. Several of the northern growers have fitted their drainage ditches with sluice gates that may be closed to raise the water, which originates in springs, to the surface of the soil during dry periods. Where a combination of open ditches and tile drains is employed it is customary to locate the ditches parallel and about 140 feet apart; the lines of tile are laid across the intervening beds and open into both ditches. One method is to use one ditch as a supply and the next as a drain during periods of drouth and simply allow the water to flow through the tiles. In this case the tiles are either laid level or given a slight fall toward the ditch serving as a drain. In case all of the ditches are used for both drainage and irrigation the tiles are graded in both directions from the center of the beds. The outlet end of the tiles should always be a few inches above the bottom of the ditch to prevent their filling with fine silt. Even the main ditches are sometimes enclosed, large tiles being used for the purpose.

Second in importance in the reclamation of the muck lands is the upbuilding of the soil flora or bacterial life of these soils. There can be no doubt that muck soils as a rule are deficient in the bacteria necessary to promote the chemical and physical changes required in the formation of plant food. We are told that all soils are the homes of countless organisms, some of which are beneficial and some detrimental to the growth of crops, and that there is a constant warfare between the two classes. Be this as it may, we are interested in supplying the organisms that work for the production of plant food through the breaking down of the coarse organic matter of the soil. On certain of the muck and glade lands it has been found that mineral manures produce very slight effect, while with the addition of stable manure the crops have been more than doubled. In fact, it has been found impossible to grow paying crops without the application of manure. In a test of muck from Canastota, New York, where cowpea stubble was applied at the rate of 5,000 pounds to the acre in conjunction with 1,000 pounds of lime, the increase in crop production was 107 per cent., or more than doubled, as against an increase of 36 per cent. in favor of the lime alone. In most cases where stable manure or cowpeas have been used in these tests the improvement in their favor has been greater than the proportion of plant foods that they contain. There are a few cases where the application of a complete fertilizer in conjunction with lime has given better results than either stable manure or cowpeas. It is natural to suppose, however, that the muck lands which have remained saturated with water for so long a period should

be deficient in bacterial life, and that the supplying of this life is an important step in their improvement. This can be best accomplished under conditions of good drainage, areation and cultivation.

Third, muck soils are in most cases of a sour or acid nature which can be corrected by the use of lime and by areation. Exceptions, as already noted, are the beds that are underlaid by marl or calcareous sand, and even these are often benefited by an application of lime, owing to the fact that the underlying strata is impervious to water and does not supply the necessary calcium carbonate to the surface soil. The application of lime gives increased yields in every case under observation except a few samples received from Indiana and Iowa, and even with these there was a great increase when the lime was applied in conjunction with cowpea stubble.

It is a well known fact that the lime requirement of muck soils differ very greatly and the proper amount to apply can best be determined by experiment. As a rule, an application of less than 500 pounds of hydrated lime to an acre would prove ineffectual. On certain of the cypress swamp muck lands of the South Atlantic Coast it was found that ten tons of lime were required to neutralize the acidity to a depth of one foot over an acre. From 1,200 to 2,000 pounds of a good grade of lime on an acre of muck land should, under most conditions, give good results. The form in which the calcium carbonate is to be applied presents another problem. Many persons who are considered authorities upon the use of lime on farm lands now claim that the form in which the calcium carbonate is applied matters little so long as it is not too caustic, also if the unburned material is used it should be ground to a very fine powder. It is a well known fact that soils containing considerable quantities of loose or broken oyster shells do not require the addition of lime, and that these soils will grow crops which thrive only where there is plenty of lime present in the soil.

Many persons are now employing the finely ground rock or oyster shells exclusively as a source of calcium carbonate. A few persons go so far as to recommend the use of flaked or coarsely ground oyster shells. There can be no doubt that the use of the finely ground, unburned rock or shells will preclude any chance of a too rapid disintegration of the vegetable matter in the soil. According to Hopkins, there is great danger of injuring the character of our highly organic soils through the use of caustic lime.

The fourth characteristic of muck soils is their deficiency in potash. Both practical and laboratory demonstrations indicate that most of these soils contain sufficient quantities of mineral salts with the exception of potash. The form in which the

necessary potash is applied will depend largely upon its source, cost of transportation, etc. Hardwood ashes are an excellent source of potash for use on muck lands, but unfortunately much of the wood ashes offered have been leached and are very low in potash content. The plan of burning the surface peat to produce potash has been extensively practiced in European countries, where the peat is plentiful, but this process would not be practicable in America, where the growth of the peat is slow or has ceased altogether. As in the case of the lime, the quantity of potash to be applied must be determined in each instance. The highest yields have occurred where the potash has been applied at the rate of 150 to 250 pounds of the element to the acre, and this in conjunction with lime and cow-peas.

The fifth characteristic of muck soils is their powerful affinity for water. On the other hand, when these soils become thoroughly dry, they are more or less unabsorbent. Observations and experiments made by Professor Davis and others show that crops growing on muck soils will "flag" or wilt much sooner than those on ordinary soils. In the case of corn, which is one of the most persistent moisture gatherers, wilting begins when the moisture content of the soil falls below 49 per cent. In sandy or loamy soils this flagging often does not occur until the moisture content is as low as 10 or 12 per cent. For practical purposes muck soils should be kept more abundantly supplied with water than other soils. The spongelike character of the muck gives it great power for retaining water, even greater than that of rank growing plants like corn to draw the moisture from it.

Crops Adapted to Muck Lands.

In European countries the muck lands are utilized for a broad range of agricultural purposes, including the growing of vegetables, grains, forage crops and pasture. Owing to the cost for draining and clearing the muck lands in this country, it would hardly be practicable, for the present at least to employ them for the production of ordinary farm crops. In the future we may expect to see a broader range of crops growing upon our muck lands, for after these lands are once drained and brought under cultivation the expense of their maintenance need not be greater than for ordinary farm lands.

For the present at least our reclaimed muck lands will be planted mainly with such crops as celery, onions, lettuce, spinach and various other truck crops. In one or two counties in Michigan vast muck beds have been successfully planted to peppermint, the product being distilled for its essential oil. Field corn may be used as a means of reducing the muck to the proper condition for the growing of truck crops, but corn

is a gross feeder and rapidly robs these soils of their available plant food and should not be planted upon them except as a means of getting them in order. In a latitude where the cow-pea can be grown it would be desirable to employ this crop for a soil renovator rather than corn or any similar crop that draws heavily upon the available plant food in the soil. For this purpose the cow-peas should be planted in rows about thirty inches apart, using from two to three pecks of seed to the acre, and cultivated until they begin to throw out runners. The tops of the cow-peas may be cut for hay, or more properly be allowed to remain upon the land and the entire growth plowed under. All fertility tests with muck soils have shown a great increase in productiveness where cow-pea stubble has been mixed with the soil, especially where small quantities of lime and potash have also been added. In this connection it should be borne in mind that the cow-pea will thrive on slightly or moderately acid soils where the clovers and other common legumes will prove a failure. The growing and turning under of cow-peas on an acid soil should invariably be followed by an application of calcium carbonate to act as a reducing agent. It should not be necessary to mention that the efficiency of the commercial lime or other form of calcium carbonate will depend almost entirely upon its being thoroughly mixed with the soil particles.

The Irish potato is another crop adapted to growing upon moderately acid soils and may very properly be employed for planting upon freshly reclaimed muck lands. Lime may be employed in conjunction with the Irish potato, provided the seed potatoes are absolutely free from scab. The fungus disease causing potato scab does not thrive in a soil showing an acid reaction, but on the other hand it develops very rapidly when once established in soil that has been limed. Irish potatoes require an abundance of potash, preferably in the sulphate form, and one hundred and fifty to two hundred pounds of the element should be applied to the acre.

It is a question if spring crop Irish potatoes can be brought upon the market as early from muck lands as from light, well drained, sandy soils, yet Mr. Frank Lindsay, one of the largest potato growers of the Portsmouth, Virginia, district is operating entirely upon muck lands in the edge of the Dismal Swamp. Mr. Lindsay found that there was a popular prejudice against potatoes grown on muck or any black soil, and that his muck-grown potatoes were selling on the market at twenty-five to fifty cents a barrel less than the ruling market price. To forestall this discrimination he put up a bond of ten thousand dollars as a guarantee that his goods would hold up just as well and prove as satisfactory as any upon the market. Recently

he has had no trouble in obtaining the regular market prices.

The common onion, together with its various closely allied forms, like the Irish potato, is well adapted to growing upon soils that are of an acid nature. The onion will thrive under conditions of comparatively poor drainage. On the rice lands of South Carolina, with the water table only a few inches below the surface, a crop of approximately 600 bushels of White Portugal onions were made to the acre. The variety known as Australian Brown also produced heavily. The great difficulty lies in the curing of onions grown on this class of soil, and after the crop is made, it is often difficult to market. This difficulty is not great on the northern muck lands, as the crop matures late in the summer and the onions are not exposed to the warm, moist climate such as prevails along the south Atlantic coast.

In the case of onion, as with the potato, considerable depends upon the variety being grown. Throughout the Great Lakes region there have been developed special strains of onions that are well adapted to growing upon the muck soils of this territory. It is a well known fact that the best results can be obtained from onion seed that is produced under the same climatic conditions as those where the crop is grown. It does not necessarily follow, however, that the seed should be produced upon the same type of soil as that upon which the crop is to be grown. For instance, the mother bulbs may be grown on muck or on sandy loam soils, but the seed should invariably be grown upon a strong clay loam, well supplied with lime and phosphates, or such soil as will produce a good yield of wheat. Onion seed is frequently grown upon muck land, especially that underlaid by marl or other calcareous material, but as a rule the seed so produced is lacking in weight and vigor.

The muck soils are especially adapted to the cultivation of onions by reason of their great water holding power. The onion belongs to the lily family, a group of plants especially adapted to growing in moist soils and therefore having a high moisture requirement. Muck soils are also adapted to the growing of onions because of the ease with which cultivation can be carried on. Onions, to be profitable, must be grown by intensive methods, although we do find the crop being handled with horse tools and as a field crop in a few instances. The usual method, however, is to plant onions in 14 to 18-inch rows and cultivate entirely with hand tools.

The fertilizer requirements for onions are similar to those of the Irish potato except that more nitrogen is required for the onion. The intensive methods under which onions are grown will justify the use of considerable quantities of commercial fertilizers that are high in nitrogen and potash. Phosphoric acid is

as a rule abundantly present in muck soils, yet it has been found profitable to add moderate quantities, making in all a rather complete fertilizer.

Perhaps the crop that gives the greatest returns to the acre on muck lands is celery. The more important early attempts to grow celery on muck lands in this country were at Kalamazoo, Michigan, where a number of Hollanders, profiting by experience gained in growing crops on reclaimed marsh lands in their native land, began to drain and cultivate small areas near the town. At first the product of these small farms was sold to the express messengers and trainmen who passed through Kalamazoo, to be again sold by them to patrons along the roads. Farmers throughout the southern part of Michigan and New York were not long in profiting by the success of these Hollanders and it was but a few years until vast tracts of tamarack swamps were being cleared and drained for celery raising.

Celery is also an intensive crop, requiring a heavy outlay for fertilizers and initial cost for preparation and planting. On the other hand, celery is one of the most profitable crops that may be grown, provided the plants are free from disease and a satisfactory market is obtained. The diseases of celery can as a rule be easily controlled, but it is essential that preventative rather than curative measures be practiced. There is at present very great interest in the production of celery and unless something arises to check the growth of the industry, we shall in all probability have a period of over-production and unprofitable prices. The adoption of storage methods for the keeping of the major part of the crop will tend to govern the marketing of celery and prolong the period of consumption.

Head lettuce has frequently proved to be a very profitable crop for growing on muck lands. Lettuce is even a more intensive crop than either onions or celery, and owing to its short period of growth requires an abundant supply of very available plant food. It is the belief of many successful lettuce growers that the nitrogen for lettuce growing should come largely from an animal source. Well composted manure is always a desirable source of plant food and humus for this class of crop, and the nitrogen from dried blood and fish scrap is considered preferable to that from nitrate of soda and sulphate of ammonia. Lettuce should be grown either as an early spring or as a late fall crop. There seems to be very little choice of varicties of lettuce for growing on muck soils, Big Boston or some selection of this variety being in demand upon our eastern markets. There is great need of a strain of head lettuce that will withstand the heat of the summer months, also for a variety that will successfully pass the winter in the open ground and give an early

spring crop. At present Big Boston is best adapted to these conditions.

Several other garden crops are grown to a limited extent upon the muck lands, including strawberries, asparagus, cucumbers, carrots, radishes, spinach, kale, cabbage, dandelion, Swiss chards and turnips. As the demand for lands suited to the growing of truck crops becomes greater the range of crops on the muck soils will doubtless increase. From the standpoint of crop production the muck soils deserve to be classed among the most valuable of our farm and garden lands. Considered in a broader sense, these lands constitute a national resource second only to our rapidly disappearing coal and timber supply. We have during the past witnessed great waste of our natural resources and have probably now reached the climax of destructive methods. Our soils, once so fertile, are now becoming depleted of that fertility through erosion and poor cropping methods. The wealth of nations is being carried from our farms into the rivers and on to the delta regions along the seashore.

In the scheme for rehabilitating our worn and depleted soils the great natural beds of peat or muck are destined to play an important part. Bulletin 218 of the Wisconsin State Agricultural Experiment Station contains a report upon the use of peat in conjunction with phosphate and potash, as compared with stable manure. The gain in favor of the peat and fertilizer was about 48 per cent.

This report further states that "when it is realized that there are nearly 2,000,000 acres of sandy soils in the state that are within easy wagon haul of abundant supplies of peat, the importance of this treatment as an available and cheap source of nitrogen can be easily appreciated."

Sooner or later we as a nation will be compelled to discontinue the waste of sewage and other refuse matter from our cities and to adopt methods of returning this fertility to our soils. There is perhaps no better absorbent for these waste materials than dry peat. By our present methods of caring for the manure from our stables much of the valuable portion is utterly lost so far as maintaining the fertility of our lands is concerned. By the liberal use of peat in the stables we can not only prevent this waste but greatly facilitate the decomposition of the manure and render it suitable for plant food.

The peasantry of European countries long since learned the value of peat as an absorbent and deodorent for refuse materials, and it is due to the thrift displayed by these simple-minded people that they have been enabled to maintain the fertility of their lands. The small farmers of Ireland and Scotland have for a long time followed the practice of maintaining

a composting pit into which goes every particle of waste material from about the farm, adding all the partially decomposed peat that the material would absorb. As a result of the use of this material on the land, they have maintained their soils in a high state of cultivation and productiveness. Where obtainable, the raw peat can be used for spreading in the barnyard to serve as an absorbent, thus keeping the yard in a sanitary condition.

There is another phase of peat utilization which should be given greater attention, namely, in preparing compost for use in forcing houses. With the great increase in the area of glass devoted to the growing of vegetables, there is a demand for soils suitable for the purpose. There is perhaps no material except manure that is of so great value in the composition of forcing house soils as well decomposed muck soil. One of the great difficulties with ordinary soils in the greenhouse is their lack of moisture-holding qualities. By the addition of one part muck soil in three a greenhouse soil of excellent mechanical properties is secured. In this mixture one part should be well rotted manure and the third part of sod loam which has been composted sufficiently long to be fine and mellow. A greenhouse soil of this character is well adapted to the growing of lettuce, radishes, beets, cucumbers, and after partially exhausted will produce excellent tomatoes.

In conclusion permit me to again call attention to the need for more systematic methods of investigating the various problems connected with the utilization of our muck lands for agricultural purposes. The first step looking toward the economical improvement of our muck lands for agricultural uses would naturally be a survey of the soil flora existing in each type of soil. Following this should come field experiments with fertilizers and renovating crops, in order to determine the practical application of the laboratory investigations. With all due respect to the advocates of industrial uses of peat soils, it is high time that we should turn our attention to the preservation of these soils for the benefit of future generations through natural agricultural uses.

Utilization of Peat. In Doncaster, England, and districts there are thousands of acres of peat moors, the peat varying in depth from 4 to 10 feet, and a new company, the Peat Coke and Oil Syndicate, are about to begin the manufacture from this substance a foundry coke for steel smelting. The special feature of the coke to be produced is the low percentage of sulphur and ash—0.04 sulphur and 4.70 ash. The coke will also be available for suction gas plants. The Peat Coke and Oil Syndicate, Ltd., with offices at 210 Chapel House, New Broad Street, London, E. C., has a registered capital of £5,000 in one shilling shares.

A SUCCESSFUL PEAT FUEL PLANT.

(Written for the Sixth Annual Meeting of the American Peat Society, held at New York, N. Y., U. S. A., by Ernest V. Moore, B. Sc., Mi. E.)

Having in mind, "Recent Developments in Peat Machinery," a paper read at the last Annual Meeting of this Society, which appears in the July, 1912, Journal, the subject of this paper might be covered by stating that the plans there outlined have been carried out, except that the plant was not completely installed until late in the season, and the estimates there submitted have, on the whole, been lived up to, or bettered.

A few more details, however, may prove interesting, and as the plant about to be described is practically a continuation of the Dominion Government work at Alfred, Ont., a short resume of that work may be pardoned.

The fuel problem in Canada is a question of national concern. To those who have studied the subject, it has a very serious side to it beyond the advancing price of coal. If, for any reason the export of coal from the United States should be restricted, or worse, prohibited, the result to Canada would be alarming indeed. Nearly every industry would be tied up, and widespread suffering result. This is not a remote possibility; no less an authority than Mr. George Otis Smith, of the United States Geological Survey, in his report, advocates the prohibition of the export of coal from the United States in the following words: "Let us keep our coal at home, and with it, manufacture whatever the world needs."

Aside from the foregoing take the economic aspect of the question. Last year, 1911, 4,020,577 tons of anthracite coal were imported at a declared value of $18,794,192.00, and 10,538,315 tons of bituminous, valued at $20,498,399.00.

In 1902 the consumption of coal was 1,895 pounds per capita, in 1911 the consumption had risen to 3,588 pounds per capita, showing that Central Canada, at least, is more dependent, year by year, for fuel, upon a foreign source of supply. Last year nearly $40,000,000.00 was sent out of Canada for fuel alone.

Canadian coal deposits are either in the far West, or, far East, and the long freight haul makes the cost, particularly in Ontario and Quebec, of supplies from either point, prohibitive.

Other fuels must be sought. Wood for fuel is now so scarce that it cannot supply the country's requirements. Peat fuel is the only article in sight to supply them, and with large deposits

available the fuel question will find a solution in Canada's peat deposits.

Crude peat is not a marketable product, but machined peat is. It is cleaner, better, and cheaper fuel at from $5.00 to $5.50 per ton than anthracite coal at from $7.00 to $7.50.

While anthracite coal carries 12,000 to 14,000 heat units per pound, and peat fuel but 8,000 to 10,000, the available heat units in peat are much greater proportionately than in coal, because the waste in peat is about 4 to 5 per cent., while that in coal runs from 16 to 26 per cent. waste.

In 1907, Dr. Eugene Haanel, Director of the Canadian Government Department of Mines, being fully aware of this state of affairs, proposed to have the matter of the manufacture of peat fuel investigated. An appropriation was obtained from Parliament, and Mr. Eric Nystrom, M. E., was instructed to go to Sweden, Norway, Finland, Denmark, Germany, Holland and Ireland, and to prepare a full report on the industry. This report was made and forms one of the publications of the Department of Mines.

As a result of this report the Department purchased 300 acres of peat lands at Alfred, Ontario, and imported and erected thereon, a complete Anrep Machine Peat Plant, this being the equipment recommended by Mr. Nystrom as the best he had seen. During 1910 and 1911 the Department operated this plant for demonstrating purposes. The plant was worked practically continuously and between 3,000 and 4,000 tons of fuel produced. It was demonstrated that a good fuel, suitable for long transportation, could be produced, and by selling in small lots to a large number of consumers, an idea of the market for the product, was obtained.

Needless to say, with coal constantly rising in price, this cheap and satisfactory substitute was well received, 95 per cent. of consumers in all stations of life, giving a favorable opinion of the fuel and repeating or increasing their orders. (See Bulletin issued by the Canadian Peat Society.)

The question of the cost of manufacture was the only one left open.

The plant installed by the Department was small in capacity, necessitating a great deal of hand labor which made the cost of manufacture high. Added to this, the overhead charges of management, depreciation, etc., were of necessity divided up over the number of tons made, which, being comparatively small, made this element of the cost of manufacture, proportionately high. For these two reasons, it was found that at the very low price charged by the Department, i. e., $2.50 per ton f. o. b. at the bog, the operation was not commercially profit-

able. Dr. Haanel pointed out, however, that this condition of affairs in so far as the cost of manufacture was concerned, would be materially changed if a larger unit plant were used, permitting mechanical excavation, and other labor-saving devices, and providing a much greater number of tons over which to divide overhead charges that need not be any greater.

The problem of designing this plant was such a one as every railroad contractor has to face from time to time, the problem of moving so many cubic yards of material such a distance, and the solution, the handling of a sufficiently large quantity, to make economically possible the use of such machinery as the contractor would use.

The Department also investigated another phase of the question. A producer gas generator with gas engine and direct connected electric generator were installed in the Fuel Testing Department of the Department of Mines, in Ottawa, Ont., and run continuously and exclusively on peat fuel over very considerable periods of test. The results have been highly satisfactory as are shown in Report No. 154 of the Department, now available.

These investigations used up the appropriation made by the Government for this purpose, and Dr. Haanel, convinced that further work might safely be undertaken by private capital, did not attempt to get further help from Parliament.

In the fall of 1911 negotiations were completed between the Department of Mines, and Mr. J. M. Shuttleworth, of Brantford, Ont., to continue the work at Alfred, Mr. Shuttleworth undertaking to provide a plant conforming with the general plans suggested by the Director of Mines.

Under a separate agreement with Mr. Shuttleworth, the writer undertook to design, build, install and operate this plant, and a contract was made for its delivery about the first of April last. Complete delivery was not made until the end of June. Certain alterations found necessary after it was first tried out, caused further delay, and only about the end of the season was the plant declared in satisfactory running order. About 100 tons of fuel were made under conditions that demonstrated beyond a doubt that a better quality of fuel, in uniformity of dryness, in appearance, and in the quality of the blocks themselves, than that made by the Department, was being turned out, and, the cost of manufacture was but a fraction of that experienced in the earlier operations. This new plant now stands on the bog at Alfred complete in so far as the operation of making the fuel is concerned, and ready for a full season's operation in 1913, when it is expected that work will be energetically carried on.

As now installed this plant consists of five distinct parts

which for clearness' sake will be taken up separately. They are the Power House, the Excavator and Macerator combined, an overhead Cableway, the Spreader, and the Harvesting Equipment.

The Power House is built on solid ground on the shore of the bog about a quarter of a mile from the drying field. The equipment consists of an ordinary horizontal, return tubular boiler, about 80 or 90 horsepower, encased in brick according to standard practice as to size of grate, distance from boiler shell, etc. In this connection it is interesting to note that this boiler was fired entirely with peat and that the fuel proved in every way satisfactory. With the full plant in operation, the switchboard showed a maximum of 15 amperes at 2,200 volts, or nearly 60 H. P., and at no time was there over two and one-half tons of fuel consumed in 10 hours. This fuel would average about 20 per cent. water content. A 13x30-inch Corliss engine running at 90 R. P. M., is used to turn over a 100 KVA, 3-phase, 60-cycle, 2,200-volt alternator with its exciter. These are connected up with a switchboard fully equipped with measuring instruments, and from this switchboard the power line leads to the working field on the bog. The current is carried the whole length of the drying ground, parallel to the line along which the excavator moves, and a short distance away from it.

The Excavator and Inside Tower, taken from front side. Excavator moves towards spectator. The transformer house on the excavator car is visible, and the traverser is seen at the left-hand end of the oblique bridgework; also, the trough conveying the excavated peat to the macerator.

The Excavator and Macerator were designed and patented by the late Mr. A. Anrep, of Helsingborg, Sweden, and were built entirely from plans supplied by him, the making of which

constituted his last active work with peat. Like the Anrep device installed by the Government, this combination of machinery rests on a primary car, supported by three sets of wheels, on three parallel tracks. The rails forming these tracks are in short sections, and the ties are arranged to be conveniently moved ahead from time to time as the machine progresses. On the rear side of this car is superimposed a horizontal structural steel bridgework supporting two parallel rails, at an angle of 45 degrees with the direction of the motion of the car, the reason for which will be explained later. This primary car also supports a transformer house in which is situated step-down transformers to bring the 2,200-volt current down to 550 volts, at which pressure it is distributed through a number of oil immersed starters, to a 30 H. P. induction motor which drives the macerator, a 15 H. P. motor driving the excavator proper and its auxiliary movements, a 10 H. P. motor which drives the cableway and to the trolley wires of a 5 H. P. motor on the spreader. The last two motors are connected up with the starters with flexible conductors to permit of a relative movement between the excavator-macerator and the end tower of the cableway.

Side Elevation of Traverser.

Traveling on the oblique rails already mentioned is a light steel framework which automatically moves from one side to the other the full width of the excavation, and in this is supported the excavating element. This traverser, driven by its own motor, is practically an independent device traveling slowly backward and forward on the oblique rails, excavating a layer from the working face each journey. The excavating element is a simple and strong bucket and chain elevator, the top half of which works in this framework while the lower half

is supported by an arm the outer end of which can be raised or lowered to regulate the depth of the excavation. When digging 9 feet deep this arm points downward at an angle of about 45 degrees, and owing to the oblique direction of travel of the traverser, not only the excavated face, but also the side standing wall, are left on practically a natural slope. This is a very important feature of this excavator, as it permits a second cut being made without fear of a cave in.

In operation, the primary car remains stationary, while the traverser makes one journey from one side to the other. The whole device is then moved ahead about eight inches and the traverser makes its return journey, and so on, continuously. The main car is moved ahead by power, six of its supporting wheels being drive wheels.

The excavator dumps into a trough supported on the front side of the bridgework, running the full length of its travel and from this trough the peat is delivered into the macerator which is also rigidly attached to the primary car. The current is brought from the power line by three flexible, heavily insulated

Rear View of Excavator, showing prism excavated and slope of side wall.

conductors which are plugged in on the main line each morning before the current is turned on at the power house. These conductors are sufficiently long for a day's operations.

The excavator has lived up to expectations. It cuts a clean trench up to 10 feet deep, and about 29 feet wide. Owing to the number of large roots in the Alfred bog, one attendant is necessary in the working trench to pull these out of the way of the excavating buckets and no difficulty has been experienced in working practically continuously. Should a short delay occur, however, the capacity of the excavator is so much

greater than that of the rest of the plant, that no delay is occasioned in the general operations.

The Macerator is the largest size of Anrep Macerator yet made. It will deliver raw peat for between 6 and 7 tons of fuel per hour, with a 30 H. P. motor and a larger amount with more power.

The Inside Tower, showing Loading Hopper and Buckets.

From the Macerator the peat travels or is propelled by a 16-inch spiral conveyor to a loading hopper situated on the inside end tower of the cableway.

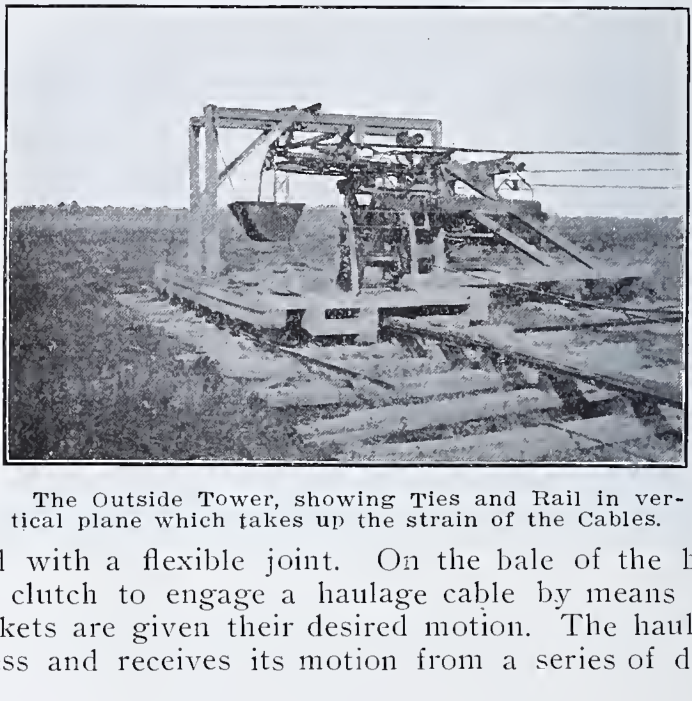
The Cableway.

The Cableway, provided to take the macerated peat to the Spreader, consists essentially of two towers placed opposite each

other about 900 feet apart, and so supported on wheels, resting on rails held in place by ties of peculiar construction, that they can move only in a direction at right angles to a line drawn from one tower to the other, the distance between the towers remaining always the same. The towers are connected by two parallel cables in the same horizontal plane strung from anchorage on them. At either end means are provided to put any desired strain on the cables, and on each tower, connecting the ends of the cables, are rigid, semi-circular tracks, so attached to the cables that a continuous and endless single track is obtained in the form of a horizontal loop, about 900 feet long, and 9 feet wide, the whole being about eight and one-half feet above the bog surface.

Intermediate between the end towers are light wooden supports spaced about every 75 feet. These also are on wheels that permit their movement only in a direction parallel to that of the end towers. They support the cable by special cable saddles as a clothes line pole supports a clothes line, thus keeping the cables parallel, and their proper distance from the ground.

Twenty-four steel buckets of 10 cubic feet capacity each are provided. They are slung in a bale that permits them to be dumped by loosening a catch. The buckets are supported from the cable track by a two-wheeled truck to which the bale is



The Outside Tower, showing Ties and Rail in vertical plane which takes up the strain of the Cables.

fastened with a flexible joint. On the bale of the buckets is fixed a clutch to engage a haulage cable by means of which the buckets are given their desired motion. The haulage cable is endless and receives its motion from a series of drums and

pulleys situated on the inside tower, i. e., the one nearest the excavator. On this tower is fixed the 10 H. P. motor driving the cableway. This cable passes out parallel to and below the track cable used to take out the loaded buckets, passes around a large cable sheave on the outside cableway tower which supports and directs it so that it still keeps directly below the semi-circular track, and, returns parallel to and underneath the track cable on which the emptied buckets return to the inside tower again. This cable is supported in the clutches on the bales of the buckets, and these are about 75 feet apart when running so that it is not possible for two loaded buckets to get between any two consecutive cable supports at the same time. The clutches are designed so that they automatically pick up and engage this haulage cable as they are pushed out, filled, from the loading hopper. When the bucket reaches the place where it is desired to dump, the clutch can conveniently be made to loosen so that the cable passes through the clutch without coming out of it, and, when the bucket is dumped, by a slight movement of the clutch lever, it again takes hold, passes the bucket around the semi-circular track on the outside tower without letting go the cable and continues to hold until the bucket arrives at the inside tower, where it receives its load again. Here the clutch automatically lets go the haulage cable, altogether, and permits it to pass over a guide pulley to the drums that give it motion. The bucket, in the meantime, continues its journey by gravity for a short distance until it is again convenient to the loading hopper.

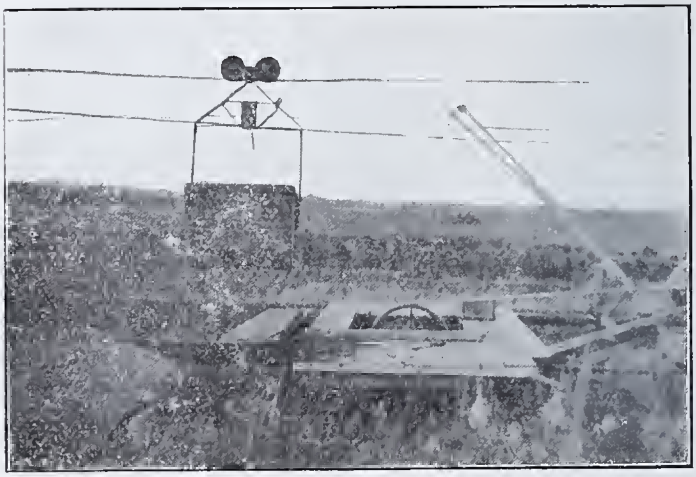
The ties supporting the end towers need some description. When the cableway is in operation a sufficient strain must be put on the track cables so that when the bucket and its load about 1,000 pounds in all, is in the center of a span, there will not be over twenty-four inches deflection. This means a strain of many tons pulling these towers together. To make the towers sufficiently heavy to resist this pull would make them too cumbersome to move, conveniently, if at all. It has therefore been necessary to anchor the ties into the bog, so that they would resist this pull and at the same time, to attach the towers to the ties so that the towers might be moved when desired, and still maintain the strain on the cables. This has been successfully done by bolting anchor plates to the under side of the ties and arranging a horizontal rail in a vertical plane, fastened to the upper side of the ties, against which vertical wheels fixed in the framework of the towers, rest, and transmit the pull on the cables to the anchor plates. By a simple arrangement the rails which take up the strain at each

end tower are adjusted so that they are parallel, and the end towers kept a uniform distance apart as they move.

On each end tower is fixed a hand winch which is used to draw in on a cable fixed to an anchorage some distance away, by which, when desired, even with the full strain on the main cables, the end towers may be moved ahead at right angles, of

The Spreader starting up, showing section of Moulded Peat. Cross-cutting Device not on.

course, to the direction of the cable strain, and parallel to the direction of motion of the excavator-macerator. So great is the strain on the track cables that the intermediate supports move along also, practically maintaining the line of the cableway.



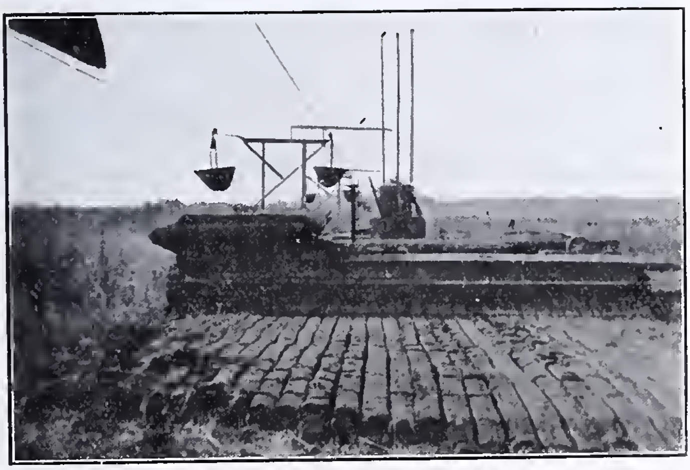
Side View of Spreader.

Finally, on the intermediate supports there is arranged a projecting arm which carries a three-wire trolley, from which

power is obtained to operate the Spreader. These wires are parallel to the cable track carrying the loaded buckets, and such distance away, that the Spreader, running underneath, is conveniently located to receive peat from the buckets.

In practice, after some minor difficulties had been overcome, this device was found to work easily and without a hitch. Patents covering it have been applied for.

The Spreader is again a device somewhat different to anything yet attempted in connection with the manufacture of machine peat fuel. It is used more or less of necessity, with a cableway or other elevated means of distributing the peat pulp, as the raw material could not conveniently be dumped into it from such dump cars as have usually been used. With this device an attempt is successfully made to place the moulded peat on the drying ground, absolutely uniform in thickness and section, and instead of dumping it with some force into the bog surface which of necessity makes it adhere and dry around small twigs, and pick up quantities of moss, etc., the moulded peat is gently laid on a surface on which all projections have been smoothed down. Again, the peat is moulded under a slight pressure and the section has rounded edges which adds materially to the quality of the finished product. The rounded corners makes less fine particles in the fuel after it has been handled two or three times in reaching the consumer's storage.



The Spreader. Cross-Cutting Device not on.

The Spreader is essentially a box into one end of which the peat pulp is dumped. It is uniformly distributed in this box by a special screw conveyor, and it is discharged again from the box which is trailed along on the ground, through thirty-four moulding spouts placed side by side in such position that the

peat is forced out without any drop, onto the ground. This is accomplished by providing a separate screw to feed each spout and arrangement is made to regulate these screws so that the peat may be delivered from the spouts at any desired rate within a big range. The box is flexibly fastened to a caterpillar tractor, designed specially for this purpose, and which, at present, hauls it along at about eighty-four inches per minute. Power is obtained from the trolley wires above and the device is steered by a tiller, conveniently placed. An attachment is also provided, fastened to the rear of the Spreader, which cross-cuts the peat uniformly every eight to ten inches as desired.

It is found that the capacity of the Spreader varies directly as the speed of its driving motor. As it has been run, thirty-four strips, 4 inches by 4 inches are laid down side by side,

A row of Fuel spread and partially dry, but not cross-cut.

making a strip almost exactly 12 feet wide. It moves 7 feet in a minute so that 12x7x1-3, equals 28 cubic feet, are spread per minute. If there were no delays this means the spreader has a capacity of 9 tons of 25 per cent. moisture fuel per hour.

The spreading box proper when loaded, with all its moving parts, weighs between three and four thousand pounds and as it is dragged over the drying field surface, all twigs, bits of moss, in fact, small inequalities in the bog surface itself, are smoothed down, and the peat gently laid on. The adjustment permitting the regulation of the rate at which the peat leaves the moulding spouts permits keeping this exactly the same as the movement of the spreading box, no matter how soft, or stiff, the pulp may be, and a very uniform section is obtained. The moulding dies are slightly rounded at the corners which moulds the peat this way also.

This device, as well as the others, has proven most satisfactory, producing a fuel evidently superior to that made from the same raw material by less complete methods of moulding. Like the cableway, patents have been applied for, to cover it.

In operation all these devices work harmoniously together. The drying area at Alfred, at present, is a rectangle three thousand feet long north and south, and a thousand feet wide, east and west. The Excavator, starting at the northeast corner, works along the eastern boundary in a southerly direction. It cuts out a prism 29 feet wide and the full depth of the peat. This is spread directly west of the Excavator, everything dug in a forward movement of this device of thirteen feet, nine inches, being spread in a strip twelve feet wide, running east and west. To do this the Cableway is located in a straight east and west direction, the inside tower being adjacent to the Excavator, and to the sixteen-inch spiral conveyor leading from the Macerator.

When the plant is in operation the Excavator moves ahead in eight-inch steps for a distance of thirteen feet, nine inches.

General View of Drying Field.

The loading hopper on the cableway tower is this long, so that no matter where the excavator is in this length of movement, it discharges into the loading hopper. From here it is dispatched, seven buckets every two minutes, along the cableway, from which it is dumped into the Spreader and laid on the bog surface, moulded. As soon as the Excavator has reached the end of a thirteen foot, nine inch run, it is stopped, while the end towers, and with them the whole cableway, is moved ahead another thirteen feet, nine inches, by means of the winches provided for this purpose, and the Spreader is turned around

ready for a return trip. This complete operation takes fifteen minutes of non-productive labor at present. This means about one minute lost in shifting for every ton of fuel made, but this might be cut down to one-half the amount if power were used to work the winches. In any case, it compares favorably with the smaller plants, where at best, three to three and one-half minutes are lost shifting tracks for every ton of fuel spread.

Apart from the men used at the power house, one man runs the Excavator without help except such as is given by the man removing roots out of the way. The ties and rails supporting this machine are kept moved ahead by a gang of three men who also, during the time in which one row is being spread, i. e., about two hours, move and put in place five ties for each end tower, and shift a light section of track thirteen feet, nine inches long, for each intermediate support to the track cables of the cableway. This they can do quite easily. The Cableway is operated, that is, the buckets are loaded and started away, by two attendants, and they are again dumped into the Spreader, and the Spreader looked after, by three more attendants. These men and the superintendent are all that are necessary for the com-

Peat Stacked and Ready to be Shipped.

plete operation of getting the peat moulded on the ground. The capacity of the plant, as run, is sixty tons of fuel, equal to three hundred and sixty tons of raw material, per ten hours, but, it has been operated at twenty-five per cent. greater output than this for shorter periods, and it is expected that the larger capacity can eventually be maintained under favorable conditions.

The whole plant, then, is a single combined unit nearly one thousand feet long, which starts at one end of the drying area and travels, in toto, straight down the drying area, moving

thirteen feet, nine inches each step. The fuel is left moulded on the ground in parallel rows twelve feet wide, separated by a space of one foot, nine inches.

In a few days up to a week the moulded peat is stacked by hand into little piles. This is done by contract, and when the peat is dried down to 25 per cent. water content it is ready for the cars.

The harvesting arrangements at Alfred, the last district division into which the plant was divided, have not thus far been changed from those used by the Government. Peat is loaded into tram cars holding about a ton and three-quarters and taken along twenty-four inch guage, Koppel, portable track to a loading platform where it is shoveled into box freight cars. Before any considerable quantity is shipped by the present operators, however, it is the intention to provide a light gasoline locomotive, more convenient dump cars, and a loading device to fill box cars to their capacity without having to shovel the fuel back. This will be taken up the first thing in the spring.

The plant will be operated this fall to provide fuel for next season's operations, when it is expected a full year's output will be obtained, as the plant is now complete and in order for continuous operation.

In conclusion, the success obtained with this plant, coupled with the successful and profitable operations of Peat Industries, Limited, of Montreal, Quebec, this year, makes possible the statement that peat fuel manufacture is now commercially established in Canada. True, the output this year was comparatively small, little more than last year, but a solid and practical foundation has been laid, and results obtained that are proving satisfactory to capital, and it is the firm conviction of the writer that in less than five years peat fuel will be extensively made and used in Canada, and more particularly in the Provinces of Ontario and Quebec.

The Peat Filler Industry, like all others, varies from one year to another. This seems to have been a bad year in some sections of the country on account of the heavy rainfall in the early summer, followed by cool weather throughout the season. It is reported that one plant will not manufacture the product another season. On the other hand, Florida may have one or even two new plants in the near future, as the demand of good and dry peat is being used in increasing quantities for direct application to the sandy soils of the state, it is reported, with excellent results. It will be remembered that Mr. Robert Ranson, Florida's pioneer peat filler man, has always urged this use of dry peat for fertilizer purposes.

PEAT AS FUEL.

Charles A. Davis.

(Read at the Eighth International Congress of Applied Chemistry, New York, September 7, 1912.)

Introduction. For many years it has been persistently asserted that on account of the great abundance and cheapness of coal and other high grade fuel in the United States, peat could have no place among the fuels of the country. In spite of this oft-reiterated statement, however, many people in those parts of the country where peat deposits are found, have been greatly interested in the frequent and carefully detailed reports of the growing use of peat fuel in Europe, and, in the aggregate, hundreds of thousands of dollars have been spent in more or less ill advised attempts to produce peat fuel by new and often wholly untried processes and machinery with no results of commercial value.

The entire failure of all such attempts as have been made to produce peat fuel in this country has caused those who have casually followed the course of events to attribute the lack of success to the peat, when, as a matter of fact, a careful analysis of the true state of affairs would in every case show that other and easily remedied causes were responsible.

In the great majority of instances the peat fuel plants built in the United States have been of an experimental nature. In many of these wholly untried machinery and inexperienced men were assembled, under the management of an optimistic inventor, whose knowledge of the properties of peat was limited to that acquired in experimentation, in a small way, with models of his machinery, during which no account had been taken of the costs of handling the raw material and other factors of production. In other cases failure undoubtedly was due to such causes as lack of sufficient capital, to inaccessible location, to the choice of a costly or impracticable process, or to other easily remedied errors of judgment. The small output of those plants which reached the productive stage was sold at good prices and more of the peat than could be furnished was demanded by satisfied customers. It seems worth while, therefore, to examine into the possibilities of peat as fuel and learn if it may not have a place, at least as an auxiliary fuel, in those parts of the country where it is found, to relieve in some measure those consumers who are remote from coal mines from the high prices to which other fuels have risen in the past few years.

In Northern Europe peat has been more or less extensively used for fuel or domestic purposes, since prehistoric times, and during the last few decades its use has steadily increased as the

needs of modern methods of manufacturing have created an increased demand for all kinds of fuel for generating steam and electric power. This increased use of peat fuel is especially noticeable in those European countries where peat is abundant and coal scarce. Russia, Sweden, Norway, Denmark, Holland and Germany are especially peat-using countries and the quantity annually produced in these countries probably amounts to upwards of 15 millions of tons. The exact amount, however, is very difficult to estimate, as a considerable part of the annual production is by country people who prepare it for their own use as farmers cut their own firewood in the United States. All authorities agree, however, that there is a constantly increasing annual output and that peat is being used in larger quantities each year for the generation of power, especially in Russia, Germany and Sweden.

Occurrence of Peat in the United States. Peat is found in the United States in workable quantities and in greatest abundance in the region north of the Ohio river and east of the 100th meridian, and in a narrow belt of land along both coasts near or at sea level. The southern border of the interior region is about that of the drift of the Wisconsin or last glacial ice sheet, and peat deposits are most numerous and extensive along the northern border of the district, which includes all of Minnesota, Wisconsin, Michigan, and the northern parts of Iowa, Illinois, Indiana and Ohio. New York, New England, New Jersey and the coastal plain regions of the states south of New Jersey, and the whole of Florida, also have valuable and extensive peat beds; and deposits of potential value exist in California and Oregon. It will be noted that the region thus outlined is, with few exceptions, outside of the coal producing districts and that the more northern states have a cold climate. In Minnesota and Wisconsin, during the winter of 1911-12, for example, anthracite coal, the common fuel, cost consumers from $8 to $10 a ton, in regions where there were extensive but entirely unused peat beds of excellent quality for fuel. Similar conditions were common in New York and New England.

Properties of the Raw Material. Unlike other fuels, peat is invariably associated with a very large percentage of water, so that it must be dug wet and dried before it can be burned. Commonly in the undrained bog the water content of the peat is 90 per cent or more. Where drainage can be resorted to, the water content may shrink to 80 per cent after a long time. The whole problem of the production of peat for fuel is to find some way to dig the peat and free it of the greater part of its water, so that the costs of treatment will not exceed a reasonable selling price. Stating it in another way, it consists of finding a

method by which a ton of raw, wet peat may be dug, formed into usable shape and dried at such a price that the 225 to 250 pounds of salable material obtained as the result of the processes, will pay all of the costs and yield a profit besides. The difficulty of drying wet peat is increased by the character of the material, which is partly decomposed fibrous and often woody vegetable matter mixed with colloidal organic compounds. This mixture is so retentive of water that it is impossible to drive off from it all of the associated water in any way except by evaporation. The greatest pressure only reduces the water in masses of peat to about 70 per cent, and centrifugal machines are not as effective as presses, as has been demonstrated by many costly tests.

The Methods of Producing Peat Fuel. The methods of handling peat and of getting it dry enough to burn in general use in European countries are, at first sight, absurdly simple and easy to understand. Doubtless this seeming simplicity of preparation has been the cause of most of the unsatisfactory history of attempted peat production and utilization in the United States. The processes are digging, drying, storing, and selling, and when reduced to their lowest terms, as practiced by the European peasantry, they consist of digging the peat by hand labor, the men using long, narrow spades that cut the peat out in brick-shaped blocks of uniform size. These blocks are laid out on the surface of the bog as fast as cut and left to dry out by exposure to the sun and air, the only attention given them being to turn them from time to time as drying progresses. When dry enough, the bricks are stacked in open conical piles, in which they are left to become thoroughly dry or until removed for use.

The material thus obtained is called cut peat, and is generally bulky, loosely aggregated, easily broken or reduced to dust. It generally burns freely and is rapidly consumed, although with some types of black, thoroughly decomposed peat, the bricks may be very dense and hard when completely dry. Although a very large quantity of cut peat is produced locally for domestic use in all peat-using countries, it does not bear transportation for long distances, and its lack of uniformity and its bulkiness make it impractical for use in power production on any considerable scale, where other fuel can be obtained. It is recently reported from Ireland, however, that cut peat bricks are used successfully in a gas-producer plant furnishing power in a woolen mill. The peat is not transported far, however, in this particular case.

The facts brought out above, combined with the early discovery that when wet peat was crushed and thoroughly ground to a uniform pulp, it would dry more quickly and make denser,

harder, tougher blocks than when simply cut from the bog, led to the development of many special machines for grinding wet peat.

These machines are practically all of the type of the brick maker's pug-mill and, in general, consist of a horizontal or vertical barrel in which turns a coarse screw for forcing the peat through the machine. In some forms the screw itself is armed with knives, which sometimes are fixed in the barrel of the machine, or they may be fixed on a separate part of the axle of the screw. Whatever the arrangement of the parts, the purpose is to macerate the peat and force it rapidly through the machine, from which, at the constricted outlet end of the barrel, it issues as a long, cylindrical or prismatic strand which may be automatically cut into bricks of standard length. The bricks in this type of machine are received on wooden pallets, on which they are taken to the drying grounds.

The most recently developed practice where peat fuel of this kind is being made on a large commercial scale, is to combine on a movable car the macerating machine with a ladder dredge. This digs the peat and delivers it automatically to the hopper of the mill, which in turn drops the bricks on a special conveyor suspended on the side of the car opposite the dredge, and this deposits them evenly on the surface of the bog, which is thus made the drying ground.

Another modification of the process is that used in Sweden and also at the experimental peat fuel plant of the Canada Department of Mines at Alfred, Ontario. By this method the freshly macerated peat it conveyed to dump cars drawn by an endless traction cable around a long, circular movable track laid out by the side of the drying area. The cars deliver the soft peat pulp to a sled-like spreading device, called a field press, which spreads the pulp on the surface of the bog in a sheet of uniform thickness, at the same time dividing the sheet into strips lengthwise with a series of trailing knives. All of the machinery is run by one engine. The sheets are cross-cut at right angles into bricks by hand tools.

Further treatment of machine peat, by whatever process it is made, after it is once spread on the drying grounds, consists in turning the bricks by hand from time to time, and after some time, piling them in low, open heaps until they are dry enough to stack.

In general, it is the present European practice to dig the peat by hand labor, partly because labor is cheap and partly because of the structure of the material, which requires that the various layers of the peat should be mixed to make the most satisfactory product. Logs and stumps in the beds may also cause frequent breakage of mechanical diggers unless they are

very strongly built. Mechanical excavators of the chain and bucket type, strongly built, are the most popular of the mechanical peat digging machine that have been tried abroad, and this construction is also being introduced into plants developed in Canada and reported satisfactory. In the United States, the dipper type of dredge, mounted on a scow, has been used to dig peat from undrainable deep bogs, and also with success in shallower ones partly drained. No difficulty has been reported in using this type of dredge if the man running the dipper is careful not to dig too close to the bottom.

The centrifugal pump has also been tried in the United States for excavating and transporting peat and found satisfactory, but a larger percentage of water is carried in the peat than in that excavated in other ways.

Portable or automobile types of peat fuel plants which combine all of the necessary machinery for digging, pulping and spreading the raw peat in a continuous automatic operation, have been mentioned. These are very compact and may be mounted either on broad trucks of the caterpillar type, such as are often used in agricultural machinery, and are moved by their own power over the surface of the bog, or they are supported on rails temporarily laid on the bog as the digging proceeds.

Mechanical plants of this kind do away with hand labor almost entirely, except for the two or three men who are needed to attend the engine and guide the plant as it is moved about on the bog, and those who work on the drying fields.

The most recent additions to the equipment for making air-dried machine peat fuel are simple and practical machines which turn the peat bricks on the drying field and when they have become dry enough, pick them up, load them on cars and, after conveying them to the storage sheds, dump them in the bins.

By the use of such machines, costly hand labor may be almost entirely eliminated from the production of air-dried machine peat. This is an important forward step, as this is the only way in which peat is produced on a large scale for use in power production.

Briquetted Peat. The scarcity and high price of good coal in Continental Europe led to an early development of the practice of briquetting coal waste and brown coal or lignite, of which great deposits exists in parts of Germany. It was found to be so easy to make satisfactory briquets of powdered lignite by the use of powerful briquetting presses, and the briquetted fuel was so satisfactory in all ways, that attempts were made to develop a similar industry based on peat, but after many years of careful and costly trials, there are at present only two

or three peat briquetting plants of rather limited capacity operating on peat in all Europe.

All writers on the subject of the use of peat agree that only the blackest and most thoroughly decomposed peat can be made into high-grade fuel briquets, so far as European presses and experience show. The most disastrous and complete failures of peat fuel plants in the United States and Canada have been those of companies which undertook to make peat into briquets.

The experience gained by the long series of extensive and costly experiments on a commercial scale shows that briquets made from most kinds of peat, slack down to powder when stored. They are easily broken when handled and generally fall to pieces in the fire, which is therefore hard to care for and wasteful of fuel. It has also been learned that it is difficult to dry the peat to just the proper degree of moisture. If it is too dry, on exposure to moist air the peat swells and the briquets fall to powder; and if it is not dry enough, the peat contracts on further drying and the briquets crack and drop to pieces.

For the production of peat briquets, the peat must be dug, partly air-dried, powdered and the drying completed by artificial heat, after which it must be pressed into the required form by great pressure developed in a specially designed briquetting press, either with or without a binder.

Many attempts have been made to perfect plants that will carry on all of these processes by machinery on a commercial scale simultaneously, and millions of dollars have been spent in this country and in Europe to attain this end, but without success.

The advantages of such a plan are obvious. Aside from the fact that good peat briquets are easily handled and very efficient fuel, if they can be produced in a plant that is independent of the weather conditions, they can be made all the year round. Despite the many extensive and costly tests that have been made, the writer, after careful inquiry, has not been able to learn of one place where a continuously operating mechanical peat briquetting plant has been in successful operation.

The fundamental cause for this lies in the difficulty of drying the peat. There is also the incontestible fact to be met, that in a ton of wet peat with 90 per cent moisture, there is not enough fuel to dry out the water and have any peat left to sell after the drying is done. This can easily be shown by the following simple calculation: A pound of a good quality of peat when perfectly dry may have a heating value of 9,000 British thermal units. A short ton of peat with 90 per cent water content yields 200 pounds of theoretically dry peat and 1,800 pounds of water. It is well known that it requires over 1,100 B. t. u. to convert a pound of water into steam or evaporate it. There-

fore we have the total amount of water which the 200 pounds of dry peat could evaporate expressed by the fraction $\frac{900 \times 200}{1100}$ which, on reduction, becomes about 1600. There would therefore still be 200 pounds of water unevaporated and no peat left to show for the operation. This statement of the problem assumes theoretically perfect conditions not only in the dryness of the fuel burned, but also in the efficiency of the drier used. As the makers of the best type of drying machinery only claim 75 per cent efficiency for their driers, and some in actual commercial use only attain an evaporative efficiency of one-third of the theoretical value of the fuel consumed, that is such driers would use 600 pounds of peat to dry out the water from less than 200 pounds. In some peat plants this was about the ratio of the consumption of fuel to production.

Drying Peat for Fuel. The problems connected with drying peat artificially on a commercial scale are so complicated, both scientifically and technically, that they cannot even be mentioned in a paper of this character, but the statement can be made without qualification that it is entirely impracticable, if not impossible, to take wet peat as it comes from the bog and dry it by artificial means for fuel purposes, unless there are large quantities of heat available that would otherwise be wasted. In such a case the dried peat is not a principal product, but to all intents and purposes a by-product.

These same statements should be made in regard to drying peat for other products than fuel, of which the selling price is low, and it is entirely certain that success in any peat enterprise will depend very largely on the extent to which use is made of the heat of the sun and out of doors air, to reduce the percentage of water in the peat. If artificial drying is to be used at all, it can be used profitably only to dry out peat that has less than 50 per cent. water, and as much less than this as is possible in operations that are expected to be a commercial success.

In the few successful peat briquetting plants of Europe, the peat after it is dug and formed in bricks is dried in the open air until the average moisture content is from 35 to 40 per cent., then it is crushed and the drying is finished in rotary or plate driers. The same method is followed in Sweden in drying peat powder for fuel, and in the United States for fertilizer uses, for which some 50,000 tons of peat powder were prepared and sold in 1911. The preliminary drying in this country is accomplished by draining the peat beds thoroughly, stirring the surface with harrows, and scraping up the thin top stratum

thus partly freed of moisture with scrapers operated by cable or electric power.

Peat Charcoal or Coke. Peat that has a small ash content after it is properly macerated, made into blocks and dried, can be charred or coked and when this is done in proper retorts, not only is there obtained a product equal to the best charcoal, but various chemical substances similar to those recovered from the destructive distillation of wood can be recovered as by-products of the coking process. Wood alcohol, acetic acid, ammonia compounds, phenol and tar and tar derivatives can be thus obtained. The charcoal, if properly made, is hard and tough and generally contains but small percentages of sulphur and phosphorus so that it can be used for metallurgical work in place of wood charcoal. In Europe there are a number of good sized plants making peat coke and recovering by-products. Such plants require the annual production of large quantities of air-dried peat bricks on which their success depends.

Peat coke may be combined with wet peat and pressed into briquets, in which the wet peat acts as a binder, but the process for doing this has not yet been shown to be commercially successful.

Peat Powder. In the form of air-dried powder, burned in properly designed furnaces by means of blast burners, peat makes a very satisfactory fuel, which in Sweden is now being produced and used on a small commercial scale. Exhaustive tests by competent engineers show that peat powder can be produced by the method developed in Sweden at a most which makes it cheaper than English coal, and, ton for ton, properly burned, it is about as efficient for steam generation as coal, fired under boilers in the usual way. The method of preparation is that described for drying peat to be used in briquetting. Authentic reports state peat powder has also been used as a source of heat in the reduction of iron with marked success and it might be used in Portland cement manufacture and other operations where powdered coal is now used.

The Use of Peat Fuel in Gas Producers. The most recent, and by far the most promising use of peat fuel for production is that of converting it into power or producer gas, in properly constructed gas producers located at or near peat deposits from which the fuel is taken. It may be said indeed that this use has already been shown to be entirely practicable, since in Sweden, Germany, Russia, England, and Italy for several years past commercial electric power plants, kilns and mills of several kinds have been in continuous operation, run by gas engines, the producer gas for which was derived from nothing but air-dried machine peat.

The earliest of such plants were of small size and used well dried peat, but more recently the Mond type of gas producer has been adapted to the use of peat containing as high as 70 per cent. of moisture and 5 plants of this type are now actually in operation in various European countries. In addition to gasifying the fuel, the Mond producers are designed to recover a large part of the combined nitrogen in the peat, which may exceed 3 per cent. of the total weight of the dry peat, as ammonium sulphate, in the process of cleaning the producer gas as it comes from the generators.

The largest plant of this particular type actually in operation is located on a peat moor 25 miles from Osnabruck, a city of about 160,000 inhabitants in northwestern Germany, to which it supplies high potential (30,000 volts) electric current. In addition it sends the current to the entire region for a radius of 25 miles. The plant is designed to furnish electric current equivalent to 4,000 horse-power, and, from the beginning, has furnished over 2000 horsepower; and in addition it has recovered a considerable tonnage of ammonium sulphate.

A second plant of the same kind, but about half the size, has been in operation near Orentano, Italy, for more than two years and is reported so successful, both as a producer of electric power, and of ammonia, that a second plant is now being built in Italy to utilize another large peat deposit.

Electricity is also generated from peat on a large scale at a large steam plant near Aurich, in Prussia. Here, the air-dried machine peat is burned under boilers and the electric generators are run by steam engines. At this plant it is reported that 5 pounds of dry peat give a kilowatt hour, and by 1913, at the present rate of development the plant will supply 8,000,000 kilowatt hours of energy annually.

In gas-producer plants of the Mond type as modified by Frank and Caro, it is reported that peat with as high as 60 per cent. water may be used. And in another modification of the same type of producer, it is claimed that wet peat is used, that is, with above 70 per cent. moisture. In these plants, the recovery of ammonia is reported to be from 60 to 80 per cent. of the total quantity of the combined nitrogen, and that if the percentage of nitrogen is above 2 per cent. of the dry weight of the peat, the production of ammonium sulphate almost or quite makes the running of the plant a commercial success, even if the gas is not used except for drying purposes.

The composition and heating value of peat producer gas is quite as good as and sometimes somewhat better than that made from coal in the same type of producer, and if the gas producer is adapted to the fuel, the tarry compounds are not troublesome, and the ash does not clinker, as with some grades of coal.

Air-dried peat fuel burns with a long, hot, clear flame, which gives off no black smoke, and leaves only a light powdery ash and no cinders or clinkers. It is so free from sulphur and acid fumes of all sorts that it does not corrode grate bars or boiler flues, and if the fire-boxes, grates, and furnaces are of proper size to accommodate the increased bulk of the fuel and the fine ash, keeping and tending the fires is easy.

The fuel value of theoretically dry peat ranges from about 7,000 to above 11,000 B. t. u., according to the ash content and the state of decomposition. This is reduced, however, by the presence of moisture, which is rarely below 10 per cent. and may exceed 25 per cent. in air-dried peat, if it is used the same season as gathered. In the United States but little machine peat has been used for any purpose, but in the few cases where it has been tried sufficiently long for the users to become accustomed to its peculiarities, it has found favor for all domestic uses.

It would seem, therefore, that our peat resources are well worth developing wherever conditions are such that additional fuel supplies are needed for development of the country.

Judge Cheney, of Orlando, Fla., recently appointed United States Judge for the State of Florida by President Taft, was one of the pioneer peat producers of the Southern States, if not the first in that region, to make peat fuel on a commercial scale. It was from his plant at Orlando that the peat, tested by the United States Geological Survey at the Fuel Testing Station at the St. Louis Exposition, came. It will be remembered that the peat was tested under the designation Florida No. 1, in both gas producer and boiler, and proved remarkably good fuel in both cases. The plant operated by Judge Cheney was equipped with a Leavitt peat machine, conveyors, etc., and a considerable amount of air-dried machine peat fuel was produced and used in firing the boilers of the Orlando Light and Water Company. Later operations were suspended on account of the large amount of hand labor used.

There is a large peat deposit near Buemmerstedter, Oldenburg, and prizes were offered to those describing ways and means of putting the same into practical use. The second prize of 500 marks was won by an architect, Drieling, of Bremen. No first prize was given, the same being divided in two, thus giving three third prizes of 350 marks. Forty-seven projects were received.

The Germania, of Berlin, reports that a project is under way to use the large number of unemployed labor on the peat deposits of Prussia.

MACHINE METHODS OF HANDLING PEAT IN DRYING.

T. A. Mighill, Boston, Mass.

(Read at the Annual Meeting in New York, Sept. 7, 1912.)

In very recent times, geologically speaking, there have been formed extensive surface deposits known as marshes, morasses, swamps, and bogs. However else these may differ from one another, they are all water-soaked, often overflowed, and generally subjected to a more or less periodic submergence. Such a natural deposit, consisting of decomposed vegetable substances mixed with more or less mineral matter, when deprived of its moisture, becomes a combustible material, and, if the mineral portion is not too large, a fuel.

The utilization of such deposits as fuel is an attractive proposition, and in certain localities where there is a scarcity of wood and coal, a necessity. The variety of natural deposit most generally worked for this purpose is called a bog and the product peat fuel or simply peat.

Such moist, spongy material is of necessity soft even when drained. Thus at the outset the peat manufacturer encounters two difficulties, the first the lack of a good foundation for his machinery, and the second the wet and bulky substance he proposes to convert into fuel. Whatever method he may employ in manufacturing peat fuel he must design his machinery to meet these two requirements.

His process must be a cheap one, for peat in the air-dried state has a lower thermal value than coal, nearly in the ratio of one to two, and in many localities coal is sold at a low price. To compete with coal under such conditions the peat manufacturer must limit his cost of production to less than half the price of coal per ton. To make his business remunerative he must produce peat fuel in large quantities, as his profit per ton will be small. This forces him to use machinery of large capacity and great strength. Such machines, naturally very heavy, he generally has to support on the soft surface of the bog.

The method he adopts for his work will determine the kind of machines he will have to use. He will also, on account of his small margin of profit, seriously consider their cost. Oftentimes he will purchase outfits from reliable concerns; sometimes he will invent and construct part or the whole of his machinery.

An inspection of the various processes of making peat fuel gives one the feeling that many peat men are impressed, perhaps righteously so, with the superiority of their own methods.

It is true that the peat business possesses many difficulties and there is a large field for inventive genius to improve the weak spots. Still there seems to be a considerable repetition of machines, any one of which is probably as good as any other one. This needless duplication of effort might be spared, were the energies of peat men applied more to the making of peat and less to the inventing of peat machines.

The peat manufacturer must examine the character of the peat in his bog, the depth of excavation, the surface conditions, the possibilities of drainage and the distance he has to transport his raw material, before choosing his operating devices. The final shape of the fuel must also be considered. For household fuel some prefer to make the peat into briquettes, and have to install driers and presses. Peat that must stand shipment before using must be in hard, dense lumps or briquetted to stand the rough treatment and also to save freight on its useless content of water. If the peat is to be burned at the plant, as for metallurgical or power purposes, a less compact and tough product will suffice.

It is a general rule that as human labor is replaced by machinery, the cost of production is reduced, though the cost of installing the machinery is often very considerable. To a very small peat plant the cost of substituting machines for men might be prohibitive, but in plants where large amounts of fuel must be prepared machines should be used as much as possible and operatives substituted for laborers. The present trend of peat manufacturers is in this direction. There does not seem to be any unsurmountable obstacle to making peat fuel entirely by machinery, as far as mechanical devices are concerned. I have seen peat fuel of excellent quality made where it was laid out on the drying field, marked into blocks, turned over when partly dried, gathered up and carried away, without having been touched by hand or a hand tool used upon it. I do not wish it to be inferred that it would be wise to launch forth boldly on such a project, until it can be shown whether the installation costs, expenses of operation, and repairs do not make such a process prohibitive. I believe, however, that the possibilities of increased economy of such a method are great enough to incite peat men to farther activities in this direction.

The problem before every peat man is to consider each step of his process and decide where he can and when he cannot replace his laborers by machines. Where there has been developed a machine adapted to any particular operation he must consider its first cost, maintenance, and efficiency. Where no machine is available he must exercise his inventive powers. He must avoid purchasing obsolete or worn out machinery or such as is not adapted to his bog. Costly mistakes can only

be avoided by a thorough understanding of his requirements and the history of peat.

To the prospective peat manufacturer there looms up a panorama of processes, of excavators, dewaterers, maceraters, conveyors, tracks, cars, driers, presses and what not. There are many methods in use and many more proposed for making peat fuel each with its specially designed machinery. At the start, when his experience is least, he is in danger of choosing the wrong method or an uneconomical one. He may purchase the accompanying machinery and later find to his sorrow his mistake. Lucky, then, will he be if he can utilize his investment in a better method. More likely he will send a good part of his machinery to the scrap heap. It is this that has made so many costly failures in the peat business.

I will now consider more specifically what is required of machines in preparing peat fuel. I will touch only on some of the more universally used machinery.

The following processes have to be undergone in most methods of peat fuel manufacture: excavation, maceration, conveying to the drying field, generally turning the partly dried blocks, generally stacking the turned blocks in small piles, and gathering up the air-dried product. The process of briquetting peat is generally different and is complicated by the addition of driers and presses. Owing to the, at present, limited field for briquettes, and the much larger one offered by the use of peat in the gas producer, I will not discuss the briquetting processes.

Peat has generally been excavated from drained bogs, but there is no reason why it cannot be dredged from undrained ones, as experience has shown.

When a peat man starts to operate he must decide whether he will drain his bog or not, for the machinery necessary in the two cases is quite different.

The drained bog has the advantage that the peat is generally dried upon its surface, while in the case of the undrained bog it will probably have to be dried on the adjacent hard land. It is thus a question of balancing the cost of drainage against the fact that most of the methods of making peat fuel demand draining the bog, and further, that the wet, heavy material is moved the minimum distance. Where bogs do not admit of natural drainage there is no other choice than upland drying, unless the proposition be of such magnitude and the reclaimed land of such value, as in some European localities, that the installation of pumping stations would be warranted.

The excavation of peat on drained bogs is generally accomplished by men with shovels. The peat is thrown into some form of elevator, usually a trough, in which runs a chain or

cable provided with push plates. The peat then falls into the peat machine or macerater. However, there are other methods where a revolving bucket and chain system or a screw or other device gnaws away at the edge of a cut in the bog. This general method may be modified in several ways by placing the excavator on the surface of the bog or at the bottom of the cut, by cutting the peat parallel or at right angles to the movement of the excavator.

There does not seem to be any inherent difficulty in using such devices, if one wishes to employ them. An excavator will have to be supported on a movable track, or on caterpillar wheels. The power used should not be large and either a gasoline or steam engine can be employed. In the latter case, extra weight is added on account of the boiler and extra provision must be made for its support. When carried on the bog, care must be taken that the excavator does not sit so close to the edge of the cut or be so heavy as to cause the bog to slump. Two or three men should be sufficient to operate it. The digging devices must be of great strength, as breakage would mean a tie-up, and where roots of any size or a sunken log are sometimes hooked onto the apparatus may be subjected to great strain. The excavator delivers the peat to the peat macerating machine, or other device for pulping it.

On an undrained bog the excavator will have to be mounted on a float. Under these circumstances, a dredge can be used. The dredge has the advantage of possessing large capacity combined with simplicity of structure and great strength. It also has the distinctive advantage of being selective and can separate the worthless material from the rest. If of the bucket type it is a distinct advantage to have the bucket provided with an independent positive closing device. With the sweep of its boom it can deposit peat over a relative large area if desired. It requires about two men to operate it and is easily moved.

To make a dense fuel, peat must be macerated. There are are many reliable and efficient forms of peat machines manufactured and in use. A machine for this purpose should be large enough to macerate a considerable fraction or even the whole of the plant's output. It should tear up small roots so that a homogeneous product may be obtained and not break if it encounters a larger root. Some concerns supply whole peat outfits, and if the prospective peat manufacturer chooses their method he will probably take their machinery as a whole.

After maceration, the peat is generally spread out to dry through the influence of sun and air. Sometimes it is put onto wooden pallets, but more generally it is spread out on the top of the bog. It is then marked in two directions, which causes it to take the form of blocks on drying. When put on pallets,

the latter are placed in the open air on gantries, or in sheds. Much machinery has been developed for these various operations. Among the devices employed have been tram cars, belts, moulds, field presses, pumps, traveling conveyors, etc. Some devices have been constructed in which several of these operations are accomplished in series, the various machines being combined into one unit. Even the excavation has been introduced into the combination and the whole operated by one or two men.

By utilizing the hard ground adjacent to the bog, it is possible to construct a drying ground adapted to the use of more capacious machinery. Such a field should be provided with a suitable bed, preferably dried and pulverized peat, in order that the peat fuel may not be contaminated by sand, clay, etc. Such a porous bed facilitates drying and affords possibilities of mechanically turning and gathering the peat. It should be provided with broad gauge tracks to carry the machines. One machine deposits the peat and marks it both ways, another simple machine turns it over and another gathers it up. At present this method has not passed the experimental stage. Its great drawback is the initial cost of such a field, which will also include a transfer table and loading machinery. The economy of such a method can only be determined by carefully comparing the costs of field and equipment with other methods and balancing this against the considerable reduction of labor that it affords. Such a proposition would probably only be suitable for power plants. Electrical power could be used and the current transmitted through the rails without much leakage, only one pair of rails being connected at one time, at least in the same part of the field.

Means of transporting the peat are necessary in any peat plant. Sometimes it is necessary to transport the wet peat and always the dry peat. For moving wet peat, light cars pulled by a cable are generally used. The cars run on a narrow gauge movable track. For raising peat short distances, conveyors with buckets or push plates are employed, for moving it short distances horizontally rubber belts are used. Other schemes for moving wet peat over longer distances use pumps or screws and force the peat through a pipe. Plunger pumps are likely to have trouble with their valves. Gear pumps have great forcing power but deteriorate rapidly on account of wearing of their parts. A screw mounted in an open trough works well but the screw must extend the full length of the trough. A short screw enclosed in a pipe will force peat for a short distance but has little forcing property and if overloaded churns the peat into a slurry and ceases to act.

Where a dredge is used the peat may be transferred on

lighters. Pipe lines are possible if an excess of water be used and the peat pumped.

The dried peat is always gathered into carts or small cars.

Turning the partly dried blocks of peat and stacking them is, as far as I am aware, always done by hand.

In a general way I have outlined what it is possible to do with machinery in making peat fuel. It is for the peat manufacturer to decide for himself what combination of mechanical devices will best suit his needs. The fact that there are so many processes now in use in different localities shows that there is no universal method of making peat fuel. He who contemplates entering this industry will do well to take the best that is available by way of machinery and use as much or as little of it as he feels to be necessary. The history of peat manufacture shows that it has progressed slowly along rather fixed lines rather than by the introduction of radical changes.

So far I have spoken only of peat manufacture where the drying is accomplished by the agencies of sun and air. Since the utilization of peat fuel for power purposes has now been established there arises the possibility of utilizing the waste heat of the plant for partially or even entirely drying the peat. Three sources of heat are available, the heat of the gases leaving the producers, the heat of the engine exhaust, and the heat developed in the cylinders which is carried off by the cooling water. All the heat except the 20-30% transformed to work in the engine is theoretically available barring some radiation loss in the producers.

By using the Mond process, peat of much larger moisture content than was believed possible a few years ago can be used, the upper limit of moisture being in the neighborhood of 70%. Under such circumstances the possibilities of entirely drying the peat by waste heat become very considerable. I have been informed that one plant has been able to dry all the fuel it consumed during the summer season by this method, it being able to secure rather drier peat than usual from a well drained bog.

Even if the peat cannot be entirely dried in this fashion there should be a greatly increased efficiency to the drying field. The greatest source of uncertainty in peat manufacture is the fickleness of climatic conditions. At the best the drying field is abnormally large and anything that will reduce this area and diminish the time and labor of operating it should be seriously considered. Furthermore, in most places the winter season forbids air drying, and the drying by waste heat will greatly reduce the overload that the drying field will have to sustain during the drying season. On the other hand, there must be considered the cost of the drying plant, the expense

of circulating the heated gases by fans or otherwise and the cost of conveying the peat to and from the driers. Also precautions must be taken to ensure an even drying of the peat to obtain a good product and also to avoid combustion of the peat by overheating in spots, of which there is said to be some danger.

In conclusion, I have attempted in a cursory way to show how machinery can be used in making peat fuel, and given a few points that must be considered in judging of the utility of such machines. I have proposed no method nor even stated my personal preference, however, I believe that the peat fuel business will only be put upon a practical economical basis as one of the world's industries through the judicious utilization of suitable machines throughout the whole or nearly the whole of the process.

The Peat For the Power Installation at Portadown, Ireland, is cut from bog lands at Maghery and dried in the open air by the usual methods. In this way the peat, containing originally from 85-95 per cent. water, can be dried to contain from 25-35 per cent. of moisture, given a fairly good drying season. During the past exceptional summer, the peat was actually dried in the open air to contain as little as 19 per cent. of moisture, as was shown by chemical analysis. At the same time, the makers guarantee the peat plant to work successfully when using peat blocks containing moisture as high as 45 per cent., although it does not pay so well to use peat in this very wet state, owing to the excessive cost of carriage in proportion to the effective fuel contained in the peat. The peat is conveyed by water in barges from the bog land on the shores of Lough Neagh to the factory, this being a very ready and cheap means of obtaining supplies.

Twenty-one Colonists have settled in the Aurich peat deposits and each has about 11 acres—many have their total area already under crops, and they have asked to have the grants made larger, as they cannot make a living from these few acres without doing other work on the side. Therefore the Society has decided in future to give each colonist about 20 acres. The situation is good, being near canals for transportation and the price varies from 100 to 600 marks per hectar (2.47 acres), according to the distance from the canal.

A peat fire near Dandstuhl, which is three-quarters of an hour from Hamburg, Germany, took place in May, 1912. The deposit of 25 acres burned for over a week and threatened the neighboring forest.

PEAT IN 1911.

By Charles A. Davis.

(Reprinted from Mineral Resources U. S. Geo. Survey.)

Production.

Fuel.

In the United States no progress can be reported in the actual production of peat fuel. So far as could be learned, but two small peat-fuel plants, making machine peat, were in operation in the country in 1911 for a part of the time only and with small total output. One of these plants was at Kalamazoo, Mich., and the other near Fertile, Iowa. Both were equipped with German peat presses or macerating machines and each made air-dried peat bricks averaging from 1 to 2 pounds in weight. The output at each plant averaged from 10 to 20 tons of salable peat fuel per day. The total output was reported at about 300 short tons; sales were reported at $5 per ton. There was a small experimental peat-fuel plant in use for a short time near Toledo, Ohio, but no commercial production was reported from it.

Peat Coke or Charcoal.

For a part of the season of 1911 a small plant for making peat coke was in operation in Connecticut. The plant was not fully completed, but produced about 25 tons of coke, valued at $350. The use of peat coke is reported to be on the increase in Europe as a substitute for wood charcoal in metallurgical and other processes in which fuel free from sulphur is required. The increased cost and inferior quality of much of the wood charcoal now furnished to American consumers should make possible the sale of a good quality of peat coke in the United States.

The peat briquetting plant at Lakeville, Ind., was reported in September to be closed indefinitely and to have made no production during the season.

Late in the year 1911 a powerful English company, controlled by the chief stockholders of a large corporation manufacturing gas producers, was formed, as announced in the public press, for the purpose of developing power and ammonia-recovery plants for utilizing low-grade fuels in various countries. One of the districts mentioned is Florida. At about the same time a large tract of peat land was acquired between Jacksonville and St. Augustine in that State to be used as a source of fuel.

Fertilizer and Fertilizer Fillers.

The production of dried peat for use as fertilizer showed a steady increase in total tonnage in 1911 in spite of bad weather, from which most of the producers suffered and which materially increased the cost of production. Heavy rainfall during the summer and autumn made air drying on the collecting areas very uncertain and also increased the quantity of water in the ground, so that digging, transporting, and drying the raw material were much more difficult and expensive than usual.

During 1911, 12 firms were engaged more or less extensively in preparing peat for fertilizer. Some of the producers reported a very small output for the use of florists and other horticulturists only, the total quantity for this trade being small. One firm of the 12 was reconstructing its plant and reported no commercial production.

Distribution of plants.—Black and thoroughly decomposed peat is most satisfactory for making fertilizer; brown and fibrous peat is less easily reduced to powder and mixes less readily with other ingredients used in making artificial fertilizers. Therefore the States in which black peats are most common are the largest producers. The factories actively engaged in preparing peat for fertilizer in 1911 were in the States named below: Connecticut, 1; Florida, 1; Illinois, 1; Indiana, 2; New Jersey, 2; New York, 3; Pennsylvania, 1; Ohio, 1.

No noteworthy changes were made in methods of preparing peat for market, but at one plant a suction-pump dredge was installed to excavate and pump the peat to the drying grounds. This method of handling the raw material was very satisfactory, so far as costs and quantity of raw material gathered were concerned, but more water was required to keep the dredge working continuously than could be obtained from the excavations, as the water found its way back to the bog very slowly from the drying ground. The principle of the suction dredge seems applicable to excavating peat from undrained bogs where large quantities of water are available, but apparently is not adapted to those where free water is not in excess.

Grades of the product.—As in former years the peat was prepared and sold for fertilizer uses in two different grades—"bone dry" and "sun dry." Bone-dry peat has been dried by artificial heat in rotary driers until it contains only about 10 per cent of moisture and has been screened to a powder of fairly uniform size. Sun-dry peat is, as the name suggests, peat that has been dried by exposure to the sun and air and by stirring and harrowing it during the drying process. Its moisture content is variable and it is sold almost entirely to furnish

organic matter for soil improvement in various horticultural operations. For these uses the demand is constantly growing.

Output and sales during 1911.—A total production of 51,733 tons of peat for fertilizer and fertilizer filler was reported for 1911, but this production does not include the output of two firms from whom no reports could be obtained. The average selling price was slightly less than $5 per ton, and sales amounting to $257,204 were reported.

Peat for Other Commercial Purposes.

Food for stock.—In 1911 there was a growing consumption of peat for miscellaneous uses, the most important of which seems to have been as an absorbent for refuse beet sugar and other molasses, so that these excellent food materials can be used to feed economically to cattle and other live stock. Charred dried peat is also used in poultry and other commercial foods for stock.

The total consumption of peat reported for these purposes was 1,995 tons, valued at $12,735.

Paper-stock manufacturing.—A single paper factory built for making peat paper reported using 500 tons of peat in 1911. This represented the consumption for but a single month, as the plant was not completed until late in the year. No valuation was given the peat by the producer.

Refrigeration.—For use in refrigeration one firm reported shipping about 500 tons of peat, valued at $375. The peat was dried before being used and was mixed with mineral matter. It serves to absorb a waterproofing substance.

Mud baths.—One producer of dried peat states that from 75 to 100 tons of dried peat are shipped annually from his factory for use in mud baths for the treatment of rheumatism and other diseases.

Peat Stable Litter.

No peat moss stable litter is known to have been produced in the United States in 1911, although a considerable quantity is annually imported into the seacoast cities of this country from Holland and Germany. The use of this material continues to increase abroad, both for stock bedding and for packing material.

The imports into the United States for the year 1911 were 9,022 short tons (8,056 long tons), valued at $39,372. This quantity was a slight increase over that imported in 1910, and the value was somewhat less.

Consumption.

The total production and consumption of peat for all pur-

poses in the United States for 1911 is, so far as reported, shown in the following table:

Production and consumption of peat in the United States in 1911, in short tons:

Use	Production		Imports		Total	
	Quantity	Value	Quantity	Value	Quantity	Value
Fuel { Machine peat.	290	$1,450	....	....	290	$1,450
Fuel { Peat coke.....	25	350	....	....	25	350
Fertilizer	51,733	257,204	....	....	51,733	257,204
Stable litter........	....	....	9,022	$39,372	9,022	39,372
Stock food..........	1,995	12,735	....	....	1,995	12,735
Refrigeration	500	375	....	....	500	375
Paper	*500	....	....	....	500	....
Mud baths..........	*100	....	....	....	100	....
Total	55,143	272,114	9,022	39,372	64,165	311,486

*Value not given.

Notes on Peat Industry in Europe.

Use of peat for generating power.—The use of peat fuel for generating power seems to be steadily increasing in those European countries where workable peat beds occur. During 1911 detailed reports have been received of the successful commercial operation, with only peat for fuel, of large electric power stations in Germany, Sweden, and Italy, and of smaller producer-gas-engine installations generating power for factories in Ireland, Russia, and England.

The most notable achievement in the use of peat fuel is the reported successful commercial adaptation of the by-products recovery gas producer to the use of peat with the relatively high water content of 50 to 70 per cent, so that not only a usable power gas can be obtained from it, but also from 70 to 85 per cent of the combined nitrogen of the peat may be recovered as ammonium sulphate, a product which always finds ready sale as a fertilizer. The largest plant of this type yet built is the electric power station at the Sweger Moor, near Osnabruck, in northwestern Germany. This plant was first put into actual commercial operation late in 1911, and during November it was reported to have furnished 428,870 kilowatt hours of electric current to consumers. In addition, during the six weeks ending about December 1 about 20 metric tons of ammonium sulphate were recovered as a by-product.

Preparation of peat fuel for gas producers in Europe.—Careful inquiry and the examination of many reports on the subject fail to show that any attempt has been made in Europe to standardize the methods of preparing peat for use in gas producers. As far as can be learned, each of the plants using peat fuel avails itself of the methods of digging the peat, shap-

ing it into blocks, and drying and storing it that are usual in the locality where the plant is situated and that time and custom have developed. At one plant the peat is cut into blocks by hand as it is dug, then air dried, and stacked until used. Generally, however, some system of machinery is used, at least for part of the work of getting the peat ready for the gas producer. The processes could and doubtless will be cheapened, but the results of the use of the fuel seem satisfactory whatever the method of preparation.

AN UP-TO-DATE PEAT PLANT — A CRITICISM.

The Journal of the Canadian Peat Society, 1912, Vol. 1, page 47, takes exception to some of the remarks made in L. B. Lincoln's paper entitled "An Up-to-date Peat Plant," which was read at the Annual Meeting of the American Peat Society, Kalamazoo, Mich., September, 1911. (See this Journal 1912, Vol. 5, p. 18.) We reprint the criticism, as follows:

In the Journal of the American Peat Society for April (Vol. 5, No. 1) appears a paper read at the Kalamazoo meeting in September last, by Mr. L. B. Lincoln, on "An Up-to-date Peat Plant." A reference to Canadian government plant at Alfred, which it contains, is very misleading and would appear to have been inserted subsequently to the reading of the paper. The paragraph reads:

"The Swedish system referred to before was investigated and an outfit was purchased by the Canadian Department of mines. It was imported and set up at Alfred at great cost as a demonstration of the air-drying theory."

"Statements of the final and unsuccessful outcome of this experiment, and how and why it was finally abandoned, are within the reach of all and we can therefore refrain from considering them at the present moment."

The outcome of the operation of the government plant cannot be fairly described as unsuccessful, in as much as the object for which is was erected has been fully achieved. It is quite true that Dr. Haanel urged the necessity of substituting mechanical equipment for the hand labor employed at the small demonstration plant, in order to establish the manufacture of peat commercially in Canada. The government plant has never been abandoned, and it did not resume operations during the present season solely because arrangements had been made whereby private capital has stepped in and erected a much larger plant embodying the features recommended by Dr. Haanel for conduct of operations on a large commercial scale. But it should not for a moment be lost sight of that the prime object of the installation of the government plant, viz., demon-

stration of the manufacture of air-dried machined peat, has been fully and successfully accomplished.

Mr. Lincoln discloses in his paper what was probably the chief reason for the unsatisfactory results he obtained last year when he says: "The third point in our system consisted during the last season of an exact copy of the 'Anrep' delivery system employed by the Canadian Government."

The delivery system referred to was specially designed for and adapted to be used in connection with small plants with a maximum capacity of 3,000 to 3,500 tons per season, in the operation of which the peat is dug entirely by manual labor, and it works satisfactorily in connection with such a plant, as the existence of hundreds of successful installations in Europe amply proves. To attempt to link up such a system, however, with a mechanical excavator of enormously greater capacity appears to have been due to an engineering oversight.

The New England Dinsmore Power Process Company has been making tests at a bog in Lynnfield, Mass., during the summer and fall, and reports substantial progress in the art of getting power from peat. The demonstration plant is well equipped.

Peat Cultivation. The Wehrkraft Verein Munich (Defense Society) is the first one in Germany to include the cultivation of peat in its program. The Muenchener Zeitung of May 17, 1912, reports that it has put 25 acres under cultivation at Schleissheim.

Trials to make use of the Pommeranian Peat have recently been made, according to the Ostsee Zeitung, of Stettin. It was demonstrated that the Gorlitzer suction gas producer showed 5½-6 times better yield in heat units generated than the Mond process.

Use of Peat in Hungary. The Hungarian Engineering and Architects' Society offered a prize of 3,000 kronen (about $1100) to travel and report on the best uses Hungarian peat can be put to. E. Vajda was presented with the prize (see this Journal, Vol. 5, p. 170).

At the experiment station of the Finnish Peat Society, tests have been made with Chili saltpeter, lime saltpeter and cyanamide. For small quantities of nitrogen the Chili saltpeter showed greatest activity; for large quantities of nitrogen the lime saltpeter proved best. The use of cyanamide showed losses of nitrogen in all cases.

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Communications intended for the Editorial Department should be sent to the Editor, Charles A. Davis, 1733 Columbia Road, Washington, D. C., or to one of the Associate Editors.

EDITORIAL COMMENT

All communications, intended for the Editorial Department of this Journal, should, until further notice, be addressed to the Acting-Editor, Herbert Philipp, Perth Amboy, N. J.

* * *

Now that we are on the eve of the old year and are making up our minds to follow some new resolutions in the coming year, we will make a few kindly suggestions here and ask our members to consider them in their program for 1913. The first and perhaps most important feature, which bears directly on the vitality of our Society, is at present our membership. As most of our members are aware the cost of editing our Journal eats up practically our total income, in fact were it not for the generosity of some of our executives we would be unable to get out some of the issues. It is therefore in the interest of all peat-friends to secure additional members and thus help the Society to better disseminate peat information and greatly

facilitate the editing of this Journal. Therefor Resolution No. 1 will formulate into: "I shall try and induce all those of my friends, who are interested in peat, to at once become members of the American Peat Society."

* * *

The Editorial Department would invite your attention and co-operation of using the pages of this Journal as a means of discussing questions of peat interests and as a conveyor of information on peat subjects. Members will confer a courtesy to the editors by keeping them posted on what is occurring in their vicinity regarding peat progress, etc.—and your editors, as well as your fellow members, will highly appreciate your efforts in this behalf. At this point we would remark that a few of our members are already kind enough to bring information of importance to the pages of the Journal and their efforts are well worth imitating. Ergo; Resolution No. 2: "I shall not forget to assist the editors of the Journal of the American Peat Society by keeping them posted on local activities in peat, as well as, use the Journal for discussions on peat subjects and occasionally communicate to them mine and others experience." Your serious perusal and conscientious conclusions of the above, embodied in your 1913 resolutions will earn you the appreciative thanks and best will of your fellow-members.

OBITUARY.

Hieronymus Graf Plaz, charter member and first president of the German-Austrian Peat Society, died in Munich on Aug. 27th last, at the age of 62.

CORRESPONDENCE.

One of our members writes us as follows:

As a member of the Society and on account of my occupation, I am very much interested in the success of the Peat Industry and it occurs to me that inasmuch as several persons have proven that money can be made from peat by applying it as a plant and animal food, that would be the way to develop peat, when it is once established and when the owner of a peat field has made some money he will feel more kindly disposed in expending money and time in the development of the fuel and power, also the recovery of the by-products of peat. I am aware that many have failed in trying to furnish peat as a plant food to the agriculturalist, but I am also thoroughly convinced that this is not the fault of the peat but of the bad business management. Peat, that is, its plant and animal food qualities (nitrogen and humus) have a relentless and far-reaching en-

emy, Mr. State Chemist, aided by Mr. State's Legislator and many Agricultural Professors, whose bugaboo is "availability," and their knowledge of availability is almost entirely based on hearsay and laboratory work. I am no chemist, but I have fully convinced myself that old Mother Nature has a process in her laboratory that when the nitrogen of peat is put in contact with other soils, she furnishes a sulphuric acid that almost totally releases the embalmed plant food elements of peat, and makes the nitrogen of peat as available as any of those supplied by animal, mineral or other vegetable sources. I get my knowledge from open field tests and have been able to convince our customers, to whom we sell, but am able to make very little headway with the chemists. I cannot induce him to forget his books written many years ago, (before general fertilizing was done in this country) long enough to make his own experiments. As to the results (general harvest out-turns) we show him, he thinks they are a selling scheme, and at once quotes Doctor, etc., and Professor, etc., that say the nitrogen in peat is not available as plant food, and when we try to get him to make a field test, proposing to stand the expense, he is too busy, etc., but still finds time to knock peat and our farmers and the general public stand for it all and pay the bill, etc. (J. W.)

* * *

One of our friends in Boston writes us that parties are proposing to erect a glass works in Massachusetts using beach sand as raw material. They hope to be able to heat their furnaces with producer gas made from peat. As some of our salt marshes are largely fresh water peat, they may be able to utilize this material to make furnace gas. I have had several conversations with them and I think they mean business.—(T. A. M.)

REVIEWS AND ABSTRACTS OF RECENT PUBLICATIONS ON PEAT.

Class I.—Peat Plant and Machinery.

Peat Plant in Italy. Die Chem. Ind. 1913, p. 554.

The Societa per utilizzazione dei combustibili Italiani has raised its capital of 800,000 lire to 2,500,000 lire for the purpose of erecting a new peat plant at Codigoro. This power plant, which is situated in the Province of Ferrara, will also recover ammonia as a by-product.

Supply of Heat in Wet Carbonizing Installations. T. Rigby and N. Testrup. British Patents 9105, Apr. 12th, 1911, and 14,131, June 14th, 1911.

In apparatus for wet carbonization of peat deposits of solid

material in the carbonizing tubes are removed, and their formation is prevented, by periodically subjecting the material in the tubes to abnormally rapid and sudden motion. This may be effected by bringing about a sudden reduction of pressure at a point of the apparatus where the pressure is relatively high.

The carbonizing tubes are heated by the furnace gases from the flue of the steam boiler or other heating device of the installation, additional fuel being supplied to such furnace to provide the necessary additional amount of heat in the flue gases. The heating of the tubes is thus more uniform than with apparatus in which the tubes are heated by a smaller volume of gas at a higher temperature. (Through J. S. Chem. Ind.)

Cleaning Tubes of Wet Carbonizing Installation. N. Testrup and O. Soederlund. British Patent 5467, Mar. 4th, 1911.

The formation of a deposit in the rotating tubes of their wet carbonizing apparatus for peat or similar apparatus is prevented by providing therein one or more loosely lying elements, such as iron rods, which scrape the interior of the tubes as it rotates. (Through J. S. Chem. Ind.)

Peat Drying Apparatus. A. S. Cairncross, Assignor to S. T. Wolfe. U. S. Patent 1,036,072, Aug. 20th, 1912.

The peat is charged into a vertical beater where it is broken up and fed into a rotary drying drum by a worm conveyor. Steam from a boiler is passed through a coil within the drum; the coil is capable of rotation and has stirring and conveying blades attached to it. The dried peat is withdrawn from the drum by a worm conveyor. The waste gases from the boiler furnace are conducted through the drum in a reverse direction to the peat. (Through the J. S. Chem. Ind.)

Class II.—Peat Fuel and Briquettes.

Fuel From Peat.—G. Weiss and W. Zeitler. German Patent 249,639. July 10th, 1910.

Dried peat is impregnated with a mixture of fused anthracene and anthracene residues, naphthaline and naphthalene residues, and nitrobenzene, and allowed to solidify in moulds. (Through J. S. Chem. Ind.)

Fuel Briquettes. N. Testrup and T. Rigby. British Patent 11,554, May 12th, 1911.

In making briquettes from wet carbonized peat as in Ekenberg's process, it has been thought necessary to dry the material before briquetting, so that it contains not more than 2 per cent. of moisture. According to the invention, wet-carbonized peat is treated in a filter-press and then dried until it contains 8 to 10 per cent. of moisture, and the material is then briquetted in an open die-press. Experiments show that the treatment in the filter-press forms minute water-channels in the

mass of the material, and that these become filled with air during the subsequent drying. The material is then very porous and the sudden impact of the die heats the air in the pores sufficiently to bring the bituminous constituents of the peat into a suitable condition for binding. (Through the J. S. Chem. Ind.)

Fuel Briquettes. A. M. Mitchell. Assignor to K. M. Widmer. U. S. Patent 1,029,022, June 11th, 1912.

The carbanaceous material is mixed with a liquid binding agent, preferably a suitable colloidal solution, and formed into a "row of successive briquettes," which are pushed through the apparatus and hardened by introducing a suitable hardening agent in a liquid state, preferably a crystalloidal solution, between the briquettes. (Through J. S. Chem. Ind.)

Class III.—Peat Distillation and Coke.

Charring Peat. A. Kesson. British Patent 18,176, Aug. 11th, 1911.

The peat is charged into metal tanks or chambers which are carried to the doors of the charring ovens by means of a conveyor, run into the ovens on rollers fitted to the floors thereof, and connected with mains for the gaseous and liquid products of distillation by means of pipes projecting horizontally from the top and bottom portions of the tanks and passing through the walls of the ovens opposite to the doors. The gas given off is passed through a cooling coil to a gas-holder, from which it is led back to the ovens for heating them. The flue gases are utilized for effecting a preliminary drying of the peat. (Through the J. S. Chem. Ind.)

Class IV.—Peat Gasification.

Peat Fuel For Power. B. F. Haanel. Dept. of Mines, Ottawa, Canada, 1912.

The report is a very detailed account of the work accomplished at the Fuel Testing Station of the Canadian Department of Mines. See also this Journal, Vol. 5, page 129.

Peat Gas Power Plant. A. Frank Pafrerztg, 1912, No. 52-2.

The peat gas plant and electrical power station on the Schweger Peat deposit was put in operation on Oct. 2nd, 1911. In October 286,046 K. W. hrs. was used in Osnabruck and November, 428,870 K. W. hrs., at the same time producing large quantities of ammonium sulphate. On account of the increasing quantities of power being used—a fourth gas engine of 1000 H. P. is being installed, which proves that the process is of commercial value.

Class VI.—Peat Fiber and Litter.

Paper From Peat. B. Granville, Assignor to National Fiber Products Co. U. S. Patent 1,038,565, Sept. 17th, 1912.

Peat is excavated and the peat fiber is separated from the bog, by applying to the peat, as it lies in the bog, a powerful stream of water, thereby "cutting" the peat and carrying the fiber in suspension in a body of water from which it may be separated. (Through J. S. Chem. Ind.)

Class VII.—Peat Deposits and Soils.

Botanical Researches in the Peat Deposits of Salzburg. H. Schreiber, Oest Moorzt, 1912, vol. 13, p. 136.

A very detailed study of the different plant families and genus of the vegetable matter in the Riedmoor deposit and the Moosmoor deposit near Salzburg, Austria.

Excavating Peat. T. Rigby and N. Testrup. British Patent 13,281, June 2nd, 1911.

To ensure a continuous supply, especially during the cold season, the peat gathered and disintegrated in one portion of the bog is transferred by means of pipes to an adjacent excavation or reservoir, from the bottom of which (i. e. below the freezing level) the material is pumped to the works. (Through S. Chem. Ind.)

Treating Peat For Drying. H. A. Muller. Swedish Patent 30,167, June 15th, 1908.

The peat is prepared by neutralizing the humus acids and adding certain bacteria, which so change the peat mass that the water may be readily removed. (Through C. A.)

Treatment of Peat. T. Rigby and N. Testrup. British Patent 22,501, Oct. 12th, 1911.

This invention relates to the drying and storage of peat. It is known that wet or very moist peat which has been exposed to frost suffers a marked decrease in calorific value, and this may easily reduce the value of peat produced by a process, where the peat containing about 55 per cent. of water is required to be stored until it can be utilized in gas producers, or otherwise disposed of if the same is so exposed. This process consists, broadly, in reducing the water content of wet carbonized peat before storage under conditions where it is liable to encounter low temperatures to such a degree that the material is free of the disadvantages referred to — e. g., reducing the water content of the same to 30-35 per cent. or thereabouts. The bulk of the liquid is separated from wet carbonized peat after it leaves the carbonizer by filter pressing, and then completing the removal of water to the desired degree by subjecting the

press cakes to the action of hot flue gases or other suitable gaseous drying medium acting directly on the same, externally applied pressure being applied, however, if desired to remove a portion of the water before submitting the material to drying by hot gas. In carrying this into effect the wet carbonized material is passed into filter presses, from which the press cakes, containing about 70 per cent. water, are transferred to a rotary drier, wherein they are exposed to the direct drying action of hot flue gases from the boilers, carbonizers, or other source, or to any other suitable gaseous drying medium. The material is in this way dried until it contains so small a quantity of water that the material cannot become deteriorated by freezing—e. g., in drying the same down to 30-35 per cent. or thereabouts. It is to be observed that the high percentage of carbon dioxide and nitrogen in the flue gases renders the risk of ignition of the material in the drier when approaching the completion of the drying extremely small.

Class XI.—Peat Chemistry.

Examination of Peat Soils. W. Bersch. Zeit. landw. Versuchw. Vol. 14, p. 1332.

Directions are given for sampling, and for making chemical and physical examinations to ascertain the suitability of the soil for agricultural uses and the best treatment to make it ready for cropping. Much dependence is placed upon physical appearance to judge the degree of decomposition of the vegetable substances. (Through Chem. Abst.)

Examination of Peat Fuel. W. Bersch. Zeit. landw. Versuchw. Vol. 14, p. 1325.

Methods of sampling and analysis are given. A calculation of the calorific value from the composition has value only in the case of coals. With lignite and peat it is essential that the calorific value be determined directly by burning in a calorimeter in an atmosphere of oxygen. Electrolytic oxygen cannot be used on account of contaminations with hydrogen. (Through C. A.)

Examination of Peat Bedding and Peat Dust. W. Bersch. Z. landw. Versuchw. Vol. 14, p. 1343.

Directions are given for sampling the peat and for the determination of the moisture content, the water absorbing capacity, and the total ash. Nitrogen, Potash and Phosphate are determined if its value in the manure is in question. To determine the water absorbing capacity 30 grm. of the peat, in which no pieces should be larger than 2 cm. in diameter, are covered with water at room temperature and the air is exhausted to secure thorough penetration of the water, then it is left to

stand for three days at ordinary pressure, after which it is allowed to drain in a wire basket, lined with filter paper and set on an incline of about 30 degrees, until it requires a minute for a drop of drainage to collect. The absorption is computed upon the dry basis and also upon the basis of the peat as received or, in case of fresh peat, upon the basis of the peat with 30 per cent. moisture. (Through C. A.)

The Availability of Nitrogen Derived from Peat. J. B. Abbott and S. D. Conner. Indiana Agricultural Experiment Station.

Wheat fertilization experiments were undertaken to determine the availability of nitrogen derived from peat as compared with nitrogen with dried blood, with results showing the superiority of blood nitrogen over peat nitrogen. The wheat showed on an average 2.4 bushels of wheat per acre more with dried blood than with peat filler. The authors do not favor the use of peat as a filler in commercial fertilizers, but state that the application of 10 or 20 loads to an acre may produce good results under certain conditions.

Humus Acid of Sphagnum Peat. S. Oden. Berichte. Vol. 45, p. 651.

The action of alkali on humus acid is not a peptization and the alkali humate is not colloidal. Several tests have shown that the action of ammonia water on humus acid results essentially in salt formation. By neutralizing caustic soda by humus acid the molecular weight of the latter was found to be about 339. From tests the humus acid appears to be tri-basic.

Class XII.—Miscellaneous Abstracts.

Aqueduct Through Peat Territory. Albert Lorenz, Oest Moorztg, 1912, vol. 13, p. 117.

This engineer describes the laying of the water supply pipes of Sebastianbery, Austria, through peat territory. Short piles were driven by hand to the bottom of the bog in two parallel lines so that one was always opposite another one. On the top of these piles a suitable piece of timber was placed upon which the pipe rested. The steel pipe was covered with material to prevent rusting from the humus acids.

Homesteading Begun in Egypt. Lord Kitchener laid the foundation stone of an agricultural school in the Egyptian Delta on November 6 and initiated a scheme for the distribution of land which has become available for cultivation through drainage. As an experiment, 610 feddans (or acres) were distributed in 5-fedden lots to the landless fallaheen (peasants), the idea being to help the poor fellaheen and at the same time to

increase the number of small landholders and to create family homesteads. During the first three years, when they must do work of reclamation, the fallaheen will receive the land practically free, and in the following ten years they will pay a moderate rental, after which the holding becomes theirs for life. Afterwards the land descends in the families if the Government approves. Alienation is forbidden, except with the consent of the State.

CONTEMPORARY LITERATURE

In Bulletin 128 of the Minnesota Experiment Station—the relation of different systems of crop rotation to humus and associated plant food is discussed. The conclusions of their results showed that the continuous cropping of corn, mangels and wheat caused a depletion of humus, whilst field peas increased the amount of humus. The increase of the humus was greatest when clover was plowed under. The changes in humus compared in fair agreement with the changes in total nitrogen and humus-nitrogen; continuous cropping caused depletion and rotation of crops an increase.

H. P.

The climate of Wisconsin and its relation to Agriculture forms Bulletin 223 of the Wisconsin Agricultural Experiment Station. The authors realize that climate is one of the factors which influence the agriculture of a state and therefore include all the factors necessary. The temperature, precipitation, sunshine and other weather conditions in relation to crops are fully covered.

H. P.

Commercial Feeding Stuffs, the title of Bulletin 161 of the Indiana Agricultural Experiment Station contains the Indiana Feeding Stuff Law and analyses of the food stuffs inspected by the state in 1911.

H. P.

Vol. 5. April, 1912 No. I.

JOURNAL OF THE AMERICAN PEAT SOCIETY

Devoted to the Development of American Peat Resources

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American Peat Society

If you are interested in any degree whatever in Agriculture, Power and Fuel, Chemistry or any other uses of Peat, you should let us help you and you help us by becoming a member of the American Peat Society.

OBJECTS AND FOUNDATION.

Founded at the Jamestown Exposition on October 23d, 1907. Its object is to further the interest in the uses and application of peat for industrial and economic purposes.

PUBLICATIONS.

The Society holds one general meeting per year, and publishes a Journal quarterly, which is sent free to all members in good standing. The journal includes the proceedings of the meetings, original papers on practical experience, etc., also abstracts on all contemporary literature and patents, thus all the latest agricultural uses, fertilizer purposes, drainage, fuel, uses, technical uses, etc.

SOME ECONOMICAL POINTS OF INTEREST.

Prof. Chas. A. Davis, U. S. Bureau of Mines, estimates that there are about 12,000 sq. miles of workable peat beds in the United States, outside of the large number of beds very advantageously adapted for agricultural purposes, etc. He gives as a conservative average estimate a yield of 200 tons dried peat per acre foot.

Canada has at least 37,000 sq. miles of known peat deposits.

The U. S. Geological Survey reports that in 1906 $45,344 worth of peat moss was imported from Europe.

About ten million tons of peat fuel are used in Europe each year.

GENERAL INFORMATION AND ENQUIRIES.

All members have the privilege of making enquiries regarding general information about peat and its uses, by addressing the Secretary of the Executive Committee.

It must be understood that only general information and of a general character can be given. Members can obtain the names of experts in any special line, from the Secretary of the Executive Committee.

Journal of the American Peat Society.

PROF. CHAS. A. DAVIS, Editor.

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